

# Compressed Air

DECEMBER 1956

*Magazine*



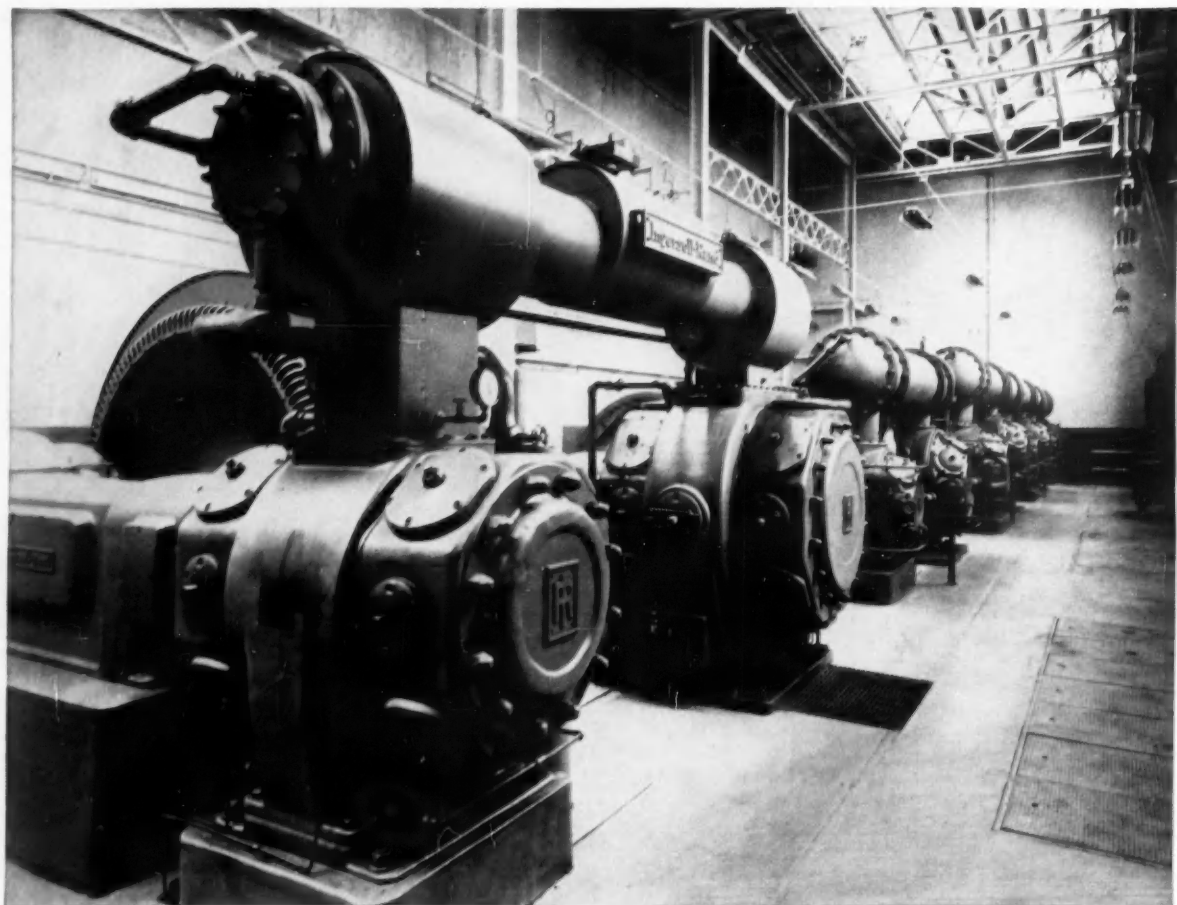
PHOTO BY WINSTON ROSE, FROM A. DEYANBY, N. Y.

NEW ENGLAND  
WINTER SETTING  
New Hampshire farmhouse  
glows amid evergreens,  
blanches and snow

SEE INDEX PAGE

VOLUME 61 • NUMBER 12

NEW YORK • LONDON



## What's the right lube for your compressors?

To assure smooth, dependable performance and low maintenance costs, the lubricant you use must:

1. Keep the entire system free from harmful deposits and rust.
2. Provide the protective lubrication that keeps compressors in service longer under all conditions.

*Texaco Regal Oil R&O* does both. Refined from choice crudes, fortified by effective additives, high in oxidation resistance — *Texaco Regal Oil R&O* keeps compressor systems clean, lines clear, rings and valves in perfect working order. Naturally, you get smoother operation, lower maintenance costs.

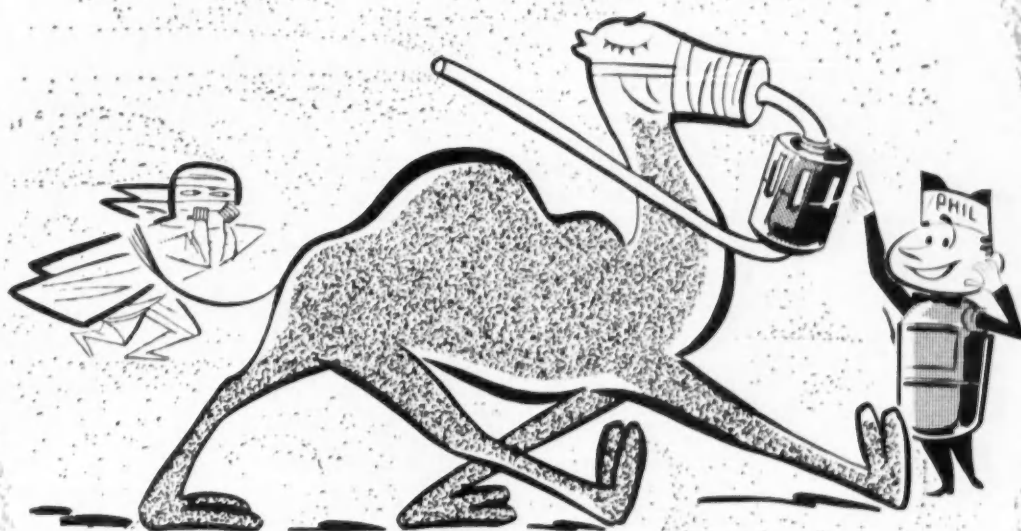
There is a complete line of *Texaco Regal Oils R&O* for every type and size compressor, every operating condition.

Let a Texaco Lubrication Engineer help you select the ones best suited to your needs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



**TEXACO Regal Oils R & O**  
FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

## KEEP IT CLEAN...by Phil Traction



Even the comical camel can figure a way to make his job easier with a Dollinger Staynew Filter. Whether you want to protect machines or processes, walls or workers from dirt, dust, grease, oil or other matter . . . there's a Staynew Filter to do the job economically, efficiently. Since 1920, Dollinger has actively engaged in the development of filter designs. Many of these designs are now considered *standard* by industries throughout the world.

### STAYNEW MODEL CPH PIPE LINE FILTER

has the exclusive "double action principle." Air is first deflected to outer walls of Filters and forced downward at high speed. Water, oil, and heavier particles of rust, etc. are thus deposited in base. Mechanically cleaned air then rises to pass through filtering medium which removes lighter air-borne particles. This "double action" design eliminates need for frequent cleaning.

Inexpensive, simple to install, Dollinger Pipe Line Filters pay for themselves in reduced maintenance alone. Why not talk over your filtration problems with a Dollinger engineer . . . or write for Bulletin 200 which gives engineering data on pipe line filters. Dollinger Corporation, 7 Centre Park, Rochester 3, N. Y.



**STAYNEW**

**DOLLINGER**



LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

Bits of Crucible Silicon-Manganese alloy steel shown in holder. They are produced by McLaughlin Manufacturing Co., Inc., Joliet, Illinois.



Operator is shown feeding 7-foot strips of steel into punch press. Crucible furnishes this steel in a special shape designed by McLaughlin engineers. After forming to finished size, the bits are heat treated and the point and cutting edge are sharpened by hand.



*special*  
**CRUCIBLE**  
*alloy*  
*steel*

**gives bits maximum impact and abrasion resistance . . .**

Cutting through abrasive materials like coal, soft limestone and shale demands a *special* steel. A steel that's hard without being brittle — that will take and *hold* a keen edge.

That's why Crucible produces a *special* Silicon-Manganese type alloy steel for the McLaughlin Manufacturing Co., Inc., manufacturers of these bits. It's a steel designed for optimum shock and abrasion resistance.

After McLaughlin tested Crucible's special alloy in the coal fields, their verdict was "This Silicon-Manganese steel is the finest alloy steel available."

Crucible will be glad to produce a *special* steel to meet your particular needs, too. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

**CRUCIBLE**

first name in special purpose steels

**Crucible Steel Company of America**



## EIMCO 105 - A LOADING CYCLE TIME SAVER

Working for a major railway firm in track maintenance operations, an Eimco 105 Tractor-Excavator provides extra-production capacity in loading out a 50-cubic-yard car every eight minutes. The Eimco loads 125 cubic yards more every hour than the machine it replaced.

For this steady job, the 105 is equipped with the high discharge rocker arms and bucket.

The Eimco replaced a 1½ yard shovel that was loading five cars an hour. Before the operator mastered extra-production features of the 105, it was loading six cars an hour. With an experienced operator, it now averages 7½ cars an hour.

Previously, one of two dozers pushing gravel toward the loading edge, came off the 50-foot-high pile to push loaded cars to the switch. The 105 now accomplishes this task

and the shovel and one dozer have been released to work elsewhere.

How does the 1½ yard Eimco, with an initial investment that is nearly one-third less, take on extra duty and still increase production?

The answer is in the 105's ability to save time during every loading cycle. With one hand, the operator pushes two, easy-to-reach levers and the Eimco moves in for a load. Powerful crowding actions fills the bucket quickly. He pulls the levers and the 105 reverses to the haulage car while the loaded bucket is elevating in an arc.

When the Eimco is in dumping position, the bucket is in discharge position. There's no lost motion between loading and discharge.

Independent track control permits the 105 to maneuver fast and sharp—another time saver.

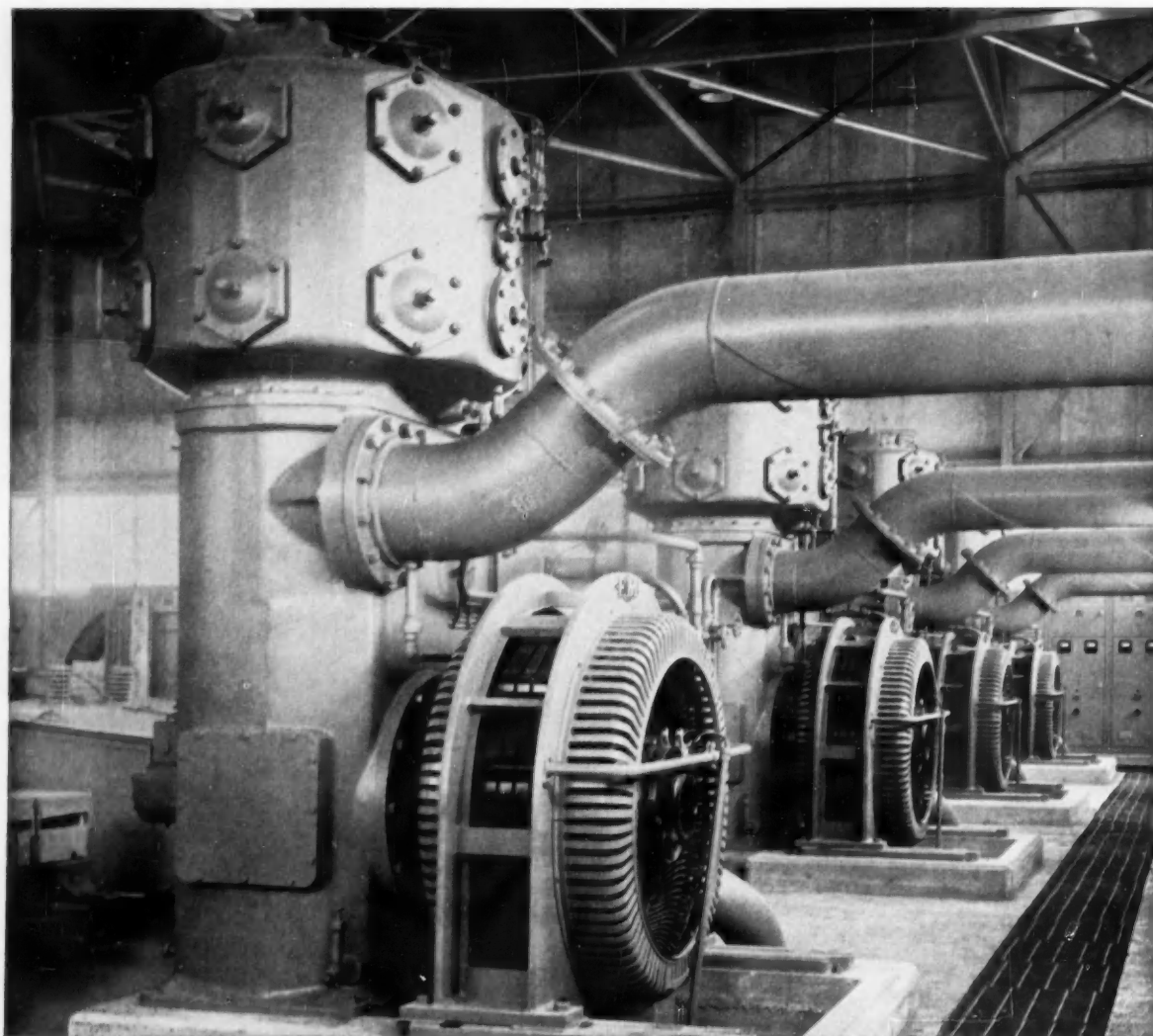
And shifting between high and low speeds—forward and reverse—is done under maximum loads at anytime without injury to the transmission. You don't have to stop to shift—or hesitate until the tachometer needle falls below the recommended RPM reading.

The best way to get an idea how the Eimco 105 will increase your production is to watch it perform. You can arrange this today by writing Eimco.

**THE EIMCO CORPORATION**  
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kalamazoo, Mich. Pittsburgh, Pa. Seattle, Wash.  
Cleveland, Ohio Houston, Tex. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa





## Start---Stop...Start---Stop...Start---Stop

● That's the way it is for these electric motor-driven compressors supplying air for underground mine use at The New Jersey Zinc Company Sterling Mine, Ogdensburg, New Jersey. Four 350 hp, 1.0 power factor, 450 rpm E-M Engine-Type Synchronous Motors, shown above, drive four two-stage air compressors which supply air for tools and other mine operations.

Since the air driven equipment in use at any given time may vary widely, the compressors are called on to operate at any of sixteen steps of loading and unloading, as selected by a specially designed sequence control panel. This means repeated starts and stops day after day, putting unusual stress on the motor windings.

E-M engineers designed these motors for rugged starting duty. The stator coils are wound and lashed with extra strength and the starting cage windings have high capacity to withstand heavy repeated starting stresses.

And here's why these E-M Motors provide a most economical, reliable, trouble-free drive for the compressors:

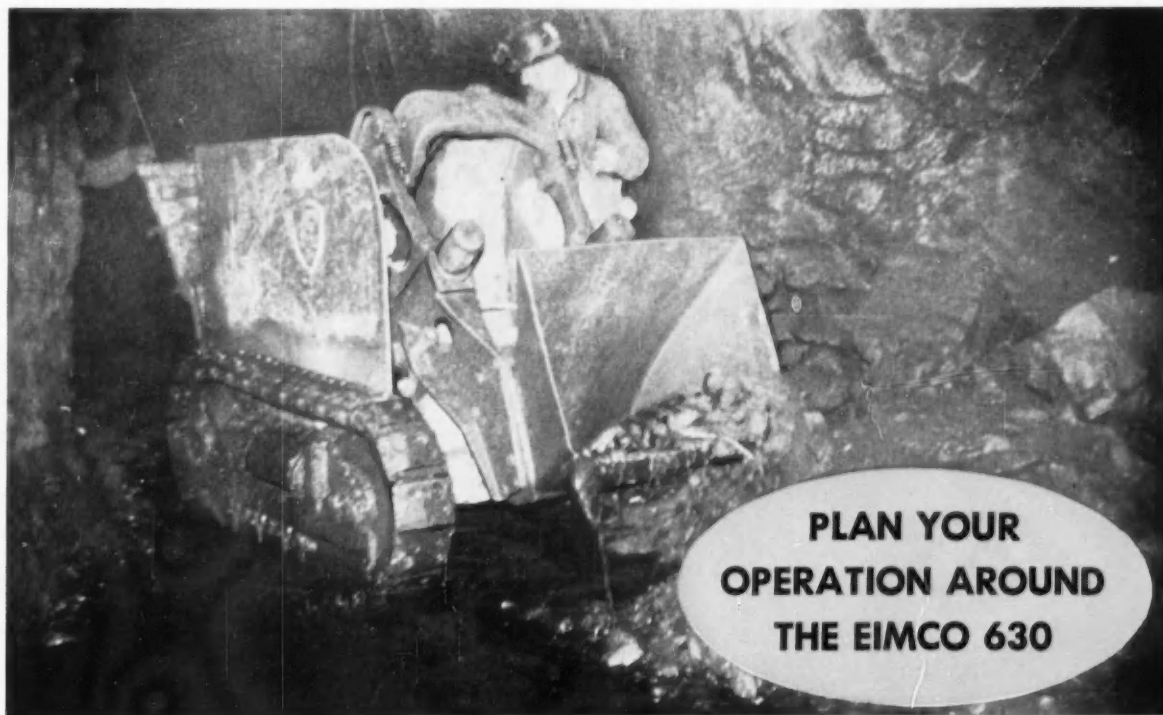
1. **High Efficiency**, utilizing electric power most sparingly.
2. **Power Factor Correction**, reducing power costs.
3. **Direct Connection**, simplifying installation.
4. **Simple Starting** with "CONSCIOUS" CONTROL, through E-M "Hi-Fuse" Control with Polarized Field-Frequency System.

For specific information on how E-M Synchronous Motors can help you get top performance from large compressors, get in touch with your nearest E-M sales engineer. Write for E-M Synchronizer No. 32 on air compressor drives.

**ELECTRIC MACHINERY MFG. COMPANY**  
MINNEAPOLIS 13, MINNESOTA

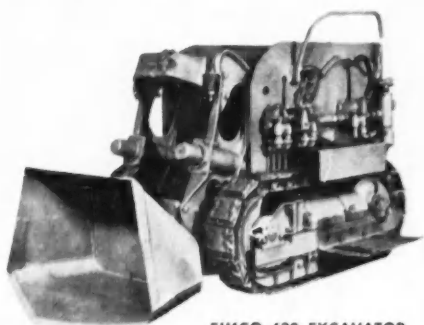


*Specialists in making motors do* **EXACTLY WHAT YOU WANT THEM TO**

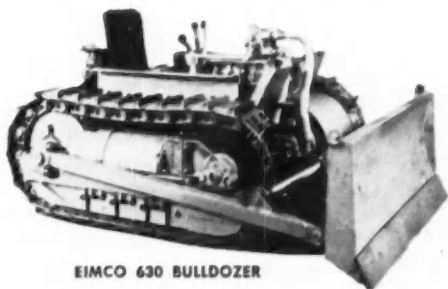


**PLAN YOUR  
OPERATION AROUND  
THE EIMCO 630**

Under the most adverse conditions, this Eimco 630 Crawler-Excavator is a production giant. But miners are discovering its capacity is even more phenomenal where mining methods are adapted to the 630's high-production features.



**EIMCO 630 EXCAVATOR**



**EIMCO 630 BULLDOZER**

A veteran European mining official—after watching the Eimco 630 Crawler-Excavator load from drawpoints—plans to adopt excavating-loading methods that permit maximum use of the 630's high-production features.

Like any other member of the industry, he wants equipment that gets the highest production rate at lowest maintenance and operating costs.

The ease with which the 630 handles digging and loading chores in confined quarters, convinced this mine manager of its extra-production, economical operating potential before he studied verifying records. And the crew, shift boss, foreman and superintendent were enthusiastic in their appraisal of the machine.

In this mine, the Eimco loads up to 435 tons during a 6½ hour shift where existing conditions do not permit it to load at full capacity. Maintenance costs are less than five cents a ton.

By adopting methods conducive to full capacity operation, production for the newly proposed mine is conservatively placed at 500 tons a shift. Maintenance and operating costs will be one-third that required by competitive equipment used previously.

The Eimco 630 has independent track control for extra maneuverability; easy-to-work levers for operating efficiency; powerful crowding action that quickly fills the big, half-yard bucket; fast discharge ability that cuts loading cycle time, and dependable, rugged construction.

The best way to form an idea how the Eimco 630 will get you more tonnage profit than any other underground mucking machine is to see it in action!

**THE EIMCO CORPORATION**

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kalamazoo, Mich. Pittsburgh, Pa. Seattle, Wash.  
Cleveland, Ohio Houston, Tex. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa



B-328



# EXPLOSIVES RESEARCH IN ACTION

This photograph of a blast of 27,000 pounds of Hercules® explosives in a traprock quarry is conclusive proof of how proper explosives technique pays off. The initial breakage was excellent, providing a sloping bank of broken rock for easy shovel digging and uninterrupted crushing and screening operations in the plant.

Achieving satisfactory results from primary blasts

requires the selection and use of the right explosives materials and methods. For more than 40 years, Hercules has pioneered in the development of improved explosives techniques for quarrying, mining, seismic prospecting, and construction. A Hercules representative will welcome the opportunity to assist in solving your blasting problems.



**HERCULES POWDER COMPANY**

INCORPORATED  
*Explosives Department, 932 King St., Wilmington 99, Del.*

Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Calif.; New York, N. Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Calif.



## EIMCO AGIDISCS DEWATER SPODUMENE

An Eimco Agidisc Filter is operating in a concentrator processing a spodumene slurry where critical problems are: (1) Heat drying method employed on the filter cake requires low moisture content and (2) solids in the feed are extremely variable and have fast settling characteristics.

The Eimco Agidisc is proving its ability to handle this difficult job by producing uniform cake formations with low moisture content at high production rates.

Its ability to keep fast settling solids in uniform suspension through strong, properly directed agitation exceeds that of any equipment previously used by this firm. The Agidisc tank shows no evidence of silting, and erosion from spodumene particles has not occurred.

The Agidisc shows these advantages over an inside drum-type filter operating in the same plant:

### THE EIMCO AGIDISC FILTER

At production rate 58.2 lbs. wet cake per minute, moisture content is 11.0%. Dry Solids: 51.8 lbs. per sq. ft. per minute.

About 80% effective filter area.

Initial cost: \$(1)X

Floor-space requirements: (1)X

Simple. Requires minutes.

DRYING  
CYCLE

EFFECTIVE  
AREA

COST

FLOOR  
SPACE

MEDIUM  
CHANGE

### INSIDE DRUM-TYPE FILTER

At production rate 58.2 lbs. wet cake per minute, moisture content is 14.3%. Dry Solids: 49.9 lbs. per sq. ft. per minute.

About 60% effective filter area.

Initial cost: \$(2)X

Floor-space requirements: (2)X

Complicated. Requires hours.

The ultimate success of any filter operation is measured in terms of economic values. Here, the Eimco Agidisc is getting more \$ value per square foot of filter area considering (1) initial cost, (2) product excellence and (3) production volume.

Eimco's modern research and development center at Palatine, Ill., has the facilities to help you choose the right "tools" for your filtration job. And there's an Eimco filter that will do the job. Write today!

**THE EIMCO CORPORATION**  
SALT LAKE CITY, UTAH

Research and Development Division, Palatine, Illinois

Export Office: Eimco Building, 51-52 South Street, New York 5, N. Y.

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

Process Engineers Inc. Division, San Mateo, California



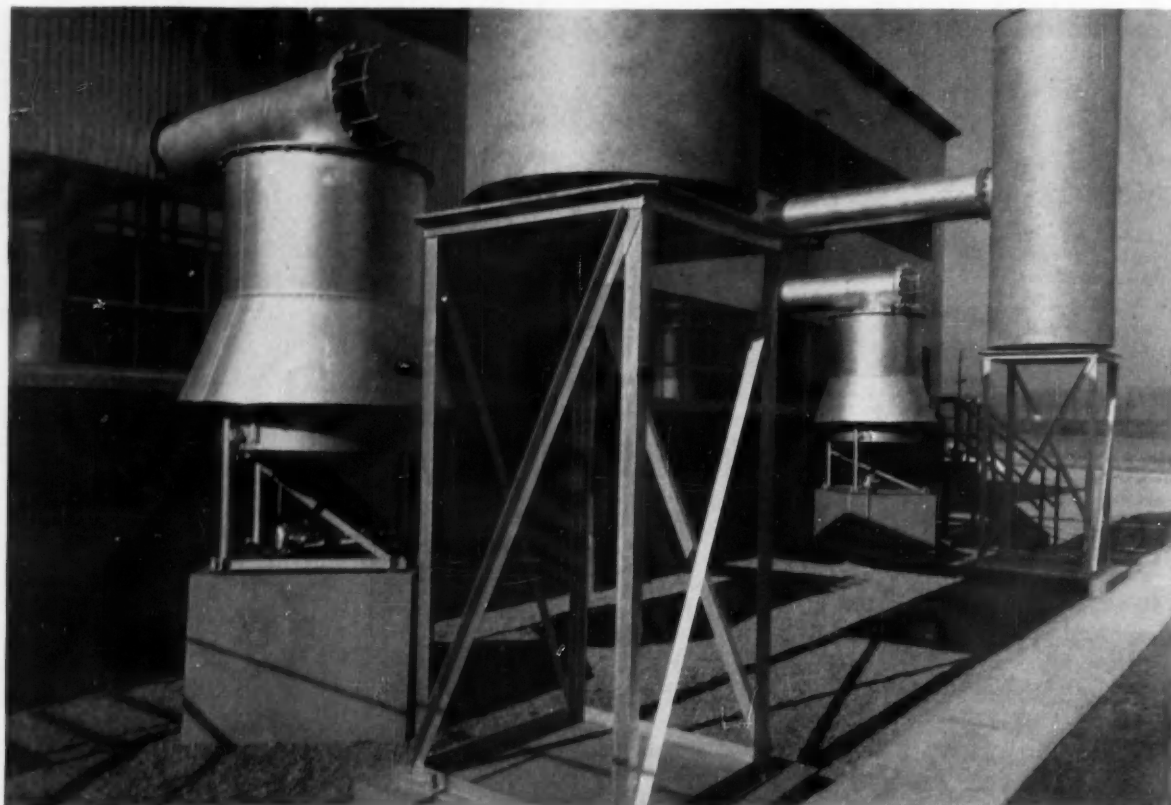
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DECEMBER, 1956

Circle 7A on reply card

Circle 8A on reply card

Adv. 9



AAF Cycoils Type "P" protect Cooper-Bessemer engines from costly dust trouble at Sugar Grove, Ohio pumping station of Ohio Fuel Gas Company.

# CYCOILS tell a *Sweet Story* at Sugar Grove

Ohio Fuel Gas Company is mighty particular about its machinery and equipment. They have to be. The big Cooper-Bessemer engines in this pumping station at Sugar Grove, Ohio, for instance, are the heart of the area's fuel gas supply. Dirty air could cause real damage.

What better reason for those AAF Cycoils Type "P" . . . protecting vital equipment, assuring uninterrupted flow of gas! Type "P" Cycoil utilizes a new principle in oil bath air filters—a perforated entrainment plate, placed in the air stream. Oil flows over the plate from a central distributing head.

Metered orifices in the plate are calibrated to increase velocity of air flow through the openings to entrain the oil that tends to spill over the edges, and distribute air flow uniformly over the area. Entrainment accomplished, air then passes upward through primary and secondary filters for removal of dust and oil content. Result is air that's virtually 100% *dust-free!*

Here's the kind of protection your engines and compressors need. Protection that saves money, blocks trouble. You get it only with AAF Cycoil Type "P". So get the facts. Write for Bulletin 160.



**American Air Filter**  
COMPANY, INC.

402 Central Avenue, Louisville 8, Kentucky  
American Air Filter of Canada, Ltd., Montreal, P. Q.



Type CMS  
Multi-Duty Filters



Type G Pipeline  
Air Filters



— BETTER AIR IS OUR BUSINESS —

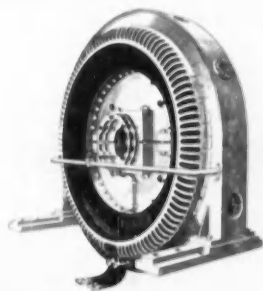
Type OCH  
Intake Air Filters



Cycoil Oil Bath  
Air Filters



**HOW GENERAL ELECTRIC SYNCHRONOUS MOTORS  
REDUCE MAINTENANCE COSTS**



AFTER WINDING OPERATION, NEW POLYEX COILS WILL BE VARNISHED TO SEAL OUT MOISTURE AND CORROSIVE OR ABRASIVE MATERIALS

## **New Polyex\* coils increase motor life**

Polyex insulated coils, a recent General Electric development, will greatly increase the life expectancy of large motors and substantially reduce maintenance requirements. Prior to being introduced into the manufacture of G-E motors, Polyex coils were subjected to numerous exacting tests to prove insulation characteristics. These tests showed that Polyex coils have many times the physical strength of conventional coils. Throughout the tests Polyex insulation retained its superior characteristics—even after being baked for thousands of hours at 125 C.

Twice the resistance of other coils to operating temperature changes, moisture, contamination and mechanical damage is possible because Polyex coils are insulated with polyester films and fibres which

are treated with the newest hydrocarbon resins. This all-dielectric insulating system is possible because the latest technological developments of chemistry and engineering are combined with the practical skills of more than a half century of coil manufacture.

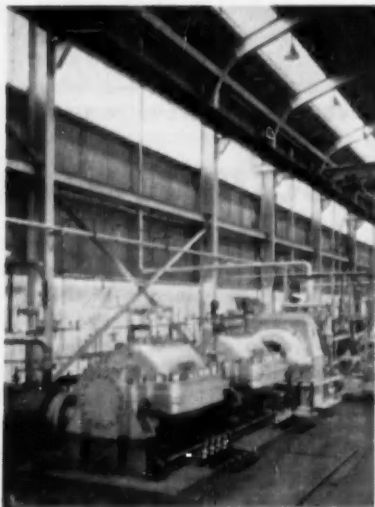
**Polyex insulated coils** are but the most recent development in General Electric's continuing efforts to provide a maximum in motor life and reduce motor maintenance to a minimum. For more information about General Electric motors, contact your Apparatus Sales Office. A sales engineer will be glad to explain the many other advantages of G-E low-speed synchronous motors. Write for Bulletin GEA-5332. Address Section 775-6, General Electric Company, Schenectady 5, New York.

\*Reg. Trade-mark of General Electric Co.

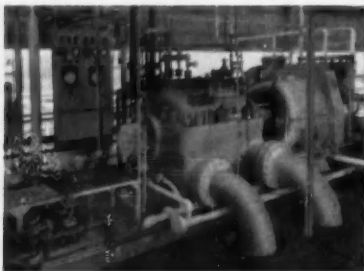
**GENERAL**  **ELECTRIC**

# Six turbo-compressors help increase capacity of

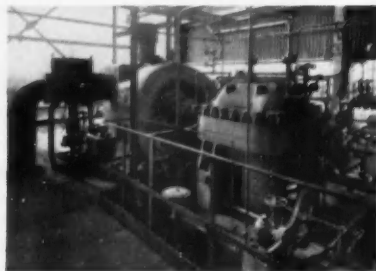
New ethylene plant of the Gulf Oil Corporation, Port Arthur, Texas. Stone & Webster Engineering Corporation, designers and constructors.



Steam-turbine driven I-R tandem centrifugal compressors in ethylene refrigeration service. Rated 3270 inlet cfm at 270 psia discharge pressure.



I-R gas compressor for handling feedstock. Rated 6230 inlet cfm at 252.7 psia discharge pressure. Driven by 4300 hp steam turbine.



I-R gas compressor, rated 11,400 inlet cfm at 264.7 psia discharge pressure. In propane refrigeration service. Steam turbine driven.

## AIR AND GAS COMPRESSORS for the process industries

Ingersoll-Rand builds a complete line of reciprocating and centrifugal compressors. Pressures range up to 35,000 psi and capacities up to 255,000 cfm. These machines are now serving in such important processing as synthesis of methanol, ammonia, rubber and toluol; hydrogenation and dehydrogenation; polymerization; and alkylation. Electric, steam, gas turbine, gas-engine, diesel and belt drive.

# World's Largest Ethylene Plant

to over a million pounds a day!

*Serving Gulf Oil's Port Arthur No. 2 unit, these  
Ingersoll-Rand compressors are employed  
for compressing process gases and refrigerants*

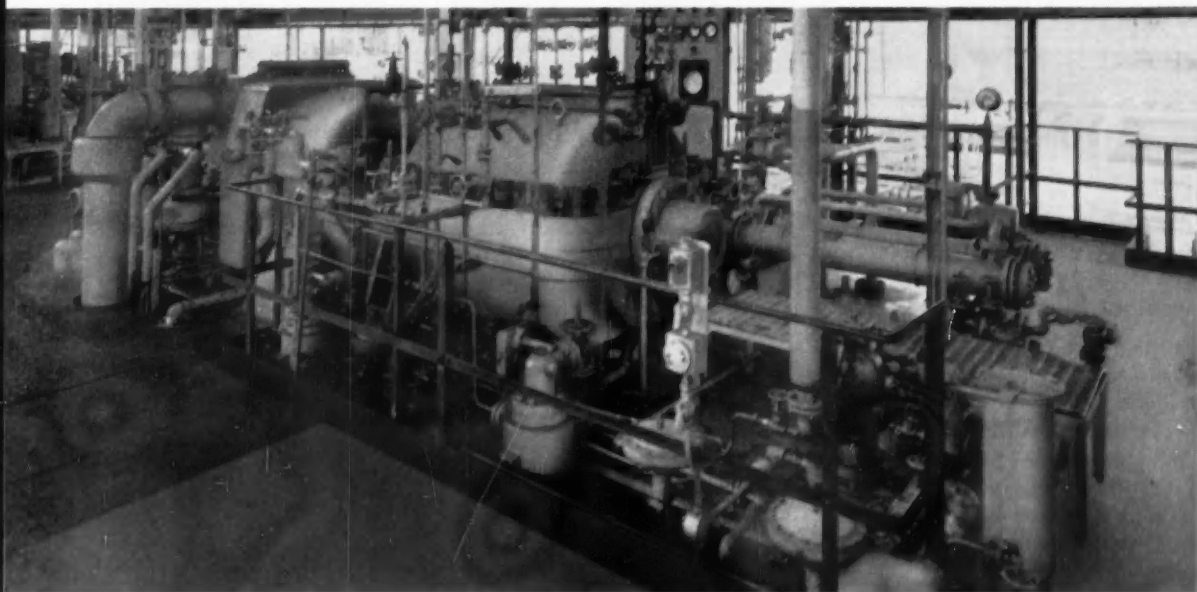
WHEN THE second ethylene unit of the Gulf Oil Corporation at Port Arthur, Texas, went on stream last year, it increased the plant's capacity by 220 million pounds a year. Now, the world's largest producer of commercial ethylene, it is supplying a growing number of customers in the Texas Gulf Coast area.

Of the six Ingersoll-Rand centrifugal compressors installed in the new No. 2 plant, three units are in process gas service. They are delivering a mixture of refinery gas and gas from the cracking furnaces to the recovery and

separation section of the unit. The remaining three I-R compressors are handling ethylene and propane for cascade refrigeration in the separation section.

For exacting operations such as these, Ingersoll-Rand compressors have for years proven unusually successful. They meet the most rigid requirements of the process industries, in which millions of horsepower have now been installed.

Your I-R engineer will welcome the opportunity to help you solve your air or gas compression problems.



Close-up of I-R gas compressor, Steam turbine driven, rated 19,100 inlet cfm at 76.2 psia discharge. For handling gases from cracking furnaces.

## Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

12-456

**IN MINNESOTA . . . AND THE WORLD OVER**  
**Profit Starts in the Pit**  
**with Bucyrus-Erie Electric Shovels On the Job**

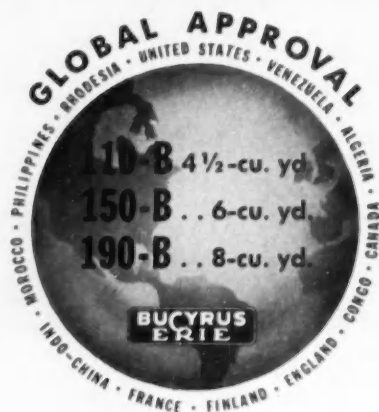


On the Mesabi range, more ore is mined with Bucyrus-Erie Ward Leonard electric shovels than any other make. The 8-yd. Bucyrus-Erie 190-B, shown here, is loading for a large mining company — only one of a fleet of Bucyrus-Eries which they operate.

It is a combination of high-output, low cost performance that makes these shovels so popular with experienced mining men. Their modern front end design and heavy-duty construction offer great strength and durability while reducing power-wasting deadweight. Ward Leonard electric control permits rapid acceleration and deceleration for high-speed, high-output work cycles.

Cut costs where costs begin — right in the pits — and get a fast start on profits. Write direct to Bucyrus-Erie for complete details.

113L56



**BUCYRUS-ERIE COMPANY**  
 South Milwaukee, Wisconsin



Schrader PILOT VALVES like the one above, and the one indicated by the red arrow, are used for remote control of air systems. Here, three are used to control the dip hopper air system. Schrader makes hundreds of air products to fit the needs of any operation. A few are indicated by red numbers, 1 through 7.

## How Schrader Air Products help give

### *3 baths to plated parts—automatically!*

Dipping baskets of plated parts in three successive baths was a monotonous, slow job at this plating company in New Haven, Connecticut. Then the operation was automated with Schrader Air Products. The dip hoppers now operate as if by magic—alone. Completion of one sequence automatically starts another. Just one more example of air at work in industry.

There is no limit to what air can do, except man's own imagination. Every day new opera-

tions are being performed with air. Its economy, efficiency and safety make it a natural for the world of tomorrow.

But *you* can get started today. Schrader engineering facilities are available upon request, to assist you in planning for the best use of air in your plant. Send for the latest informative booklets which show Schrader Air Products that can help you produce more economically.

# Schrader®

ESTABLISHED IN 1844

A. SCHRADER'S SON  
Division of Scovill Manufacturing Company, Incorporated  
478 Vanderbilt Avenue, Brooklyn 38, N. Y.



FIRST NAME IN THE USE OF AIR  
FOR INDUSTRIAL PRODUCTION AND CONTROL

# MODERN STOKER-FIRED BOILERS

Despite the relatively wide extent to which oil — and gas — have come into use for firing industrial boilers, the fact remains that coal continues to be the most economical fuel available in many areas.

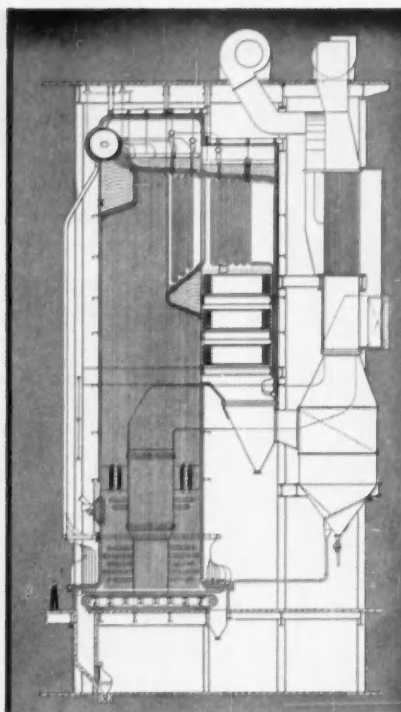
Moreover many potential coal users are unaware of the tremendous improvements that have been made in recent years in the design and general effectiveness of mechanical stokers. Here at Combustion virtually the entire stoker line has had extensive design changes, all directed at improved performance. But overall performance is tied in inescapably with boiler performance. At Combustion you have the important advantage of dealing with a leading boiler manufacturer that also offers the most complete line of stokers available anywhere. You are assured, therefore, of a completely coordinated design comprising stoker, boiler, furnace and — if desired — heat recovery equipment and/or auxiliaries, all engineered specifically for your particular requirements.

Displayed below are three — of the many — C-E stoker-fired boiler designs which, collectively, are suitable for any coal-firing conditions.

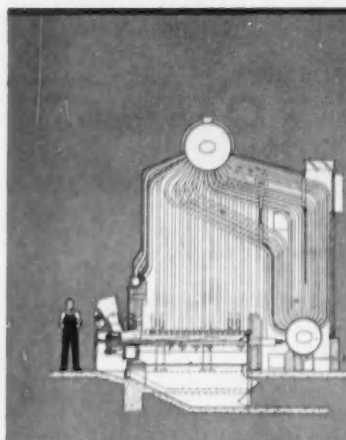
At the right is illustrated the latest — and largest — example of the C-E Bark-burning Unit, a design pioneered by Combustion and now widely used for burning bark, hogged-wood and other waste wood fuels.

So — when you are in the market for coal or other solid-fuel-burning units it will certainly be to your advantage to find out what Combustion Engineering has to offer. Our engineers will be glad to discuss your needs with you or your consultants.

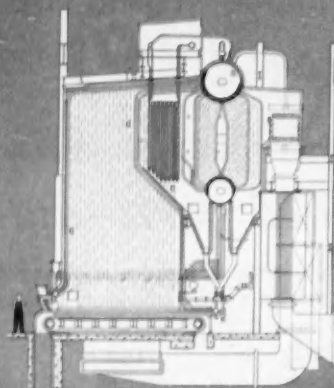
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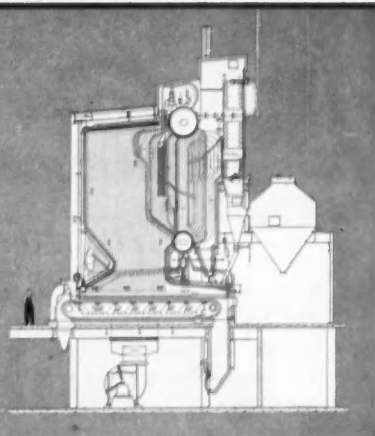
**C-E BARK-BURNING UNIT** for a paper company. This is a very large unit; capacity — 450,000 lb steam per hr, operating pressure — 1335 psig; total steam temperature — 958 F. It is designed to burn bark, natural gas, oil or any combination thereof. These units are in service for capacities as low as 20,000 lb of steam per hr.



**THIS C-E VERTICAL-UNIT BOILER, TYPE VU-10** fired by a C-E Underfeed Stoker, Type E is for a dairy. Capacity is 30,000 lb steam per hr at 150 psig. VU-10 Boilers are available for capacities from 10,000 to 60,000 lb of steam per hr. They are often equipped with C-E Spreader Stokers, dump grate type.



**ONE OF TWO DUPLICATE UNITS** for a chemical company comprising C-E Vertical-Unit Boilers, Type VU-40 fired by C-E Spreader Stokers, continuous discharge type. These are baffless boilers designed for a capacity of 150,000 lb steam per hr at 900 psig and 808 F. Coal is Eastern Bituminous.



**THIS C-E UNIT** is being installed for a soap company. It comprises a C-E Vertical-Unit Boiler, Type VU-30 fired by a C-E Traveling Grate Stoker. Coal used is Midwest Bituminous. This boiler is designed for a capacity of 100,000 lb steam per hr at 850 psig and 585 F. It is an outdoor type unit.

## COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.  
CANADA: COMBUSTION ENGINEERING—SUPERHEATER LTD.



STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; DOMESTIC WATER HEATERS; SOIL PIPE

CAST-IRON END BRACKET  
AND HOUSING

INTEGRALLY CAST  
ROTOR FANS

POSITIVE LEAD  
IDENTIFICATION

DIE CAST ALUMINUM ROTOR

PREWOUND  
STATOR

LOCKED BEARING

## Are you getting all these extras in the motors you buy?

Louis Allis gives them to you, because they  
build their standard motors with special care

For years, Louis Allis has specialized  
in special motors for many of industry's  
toughest drive problems. Such instal-  
lations call for extreme care in both  
motor design and manufacture—care  
that has become a habit with us. That's  
why we build our standard motors with  
special care.

What does this mean to you? It means  
that you get a motor with extra features  
—a motor that runs better, lasts  
longer. Here are a few of the extra  
reasons why:

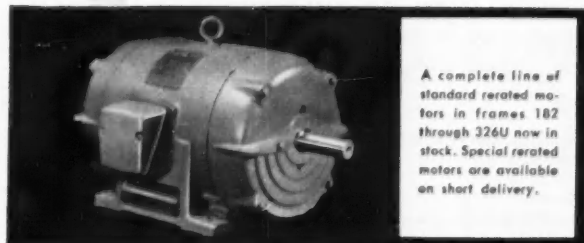
- New exclusive phenolic impregnating  
varnish provides high thermal and

chemical resistance. It remains resil-  
ient and resists aging for longer  
motor life.

- Locked bearings, inner race to shaft,  
outer race to end bracket, reduce end  
play and increase bearing life.
- Increased protection not only for the  
motor, but also for operating person-  
nel. Double end ventilation permits  
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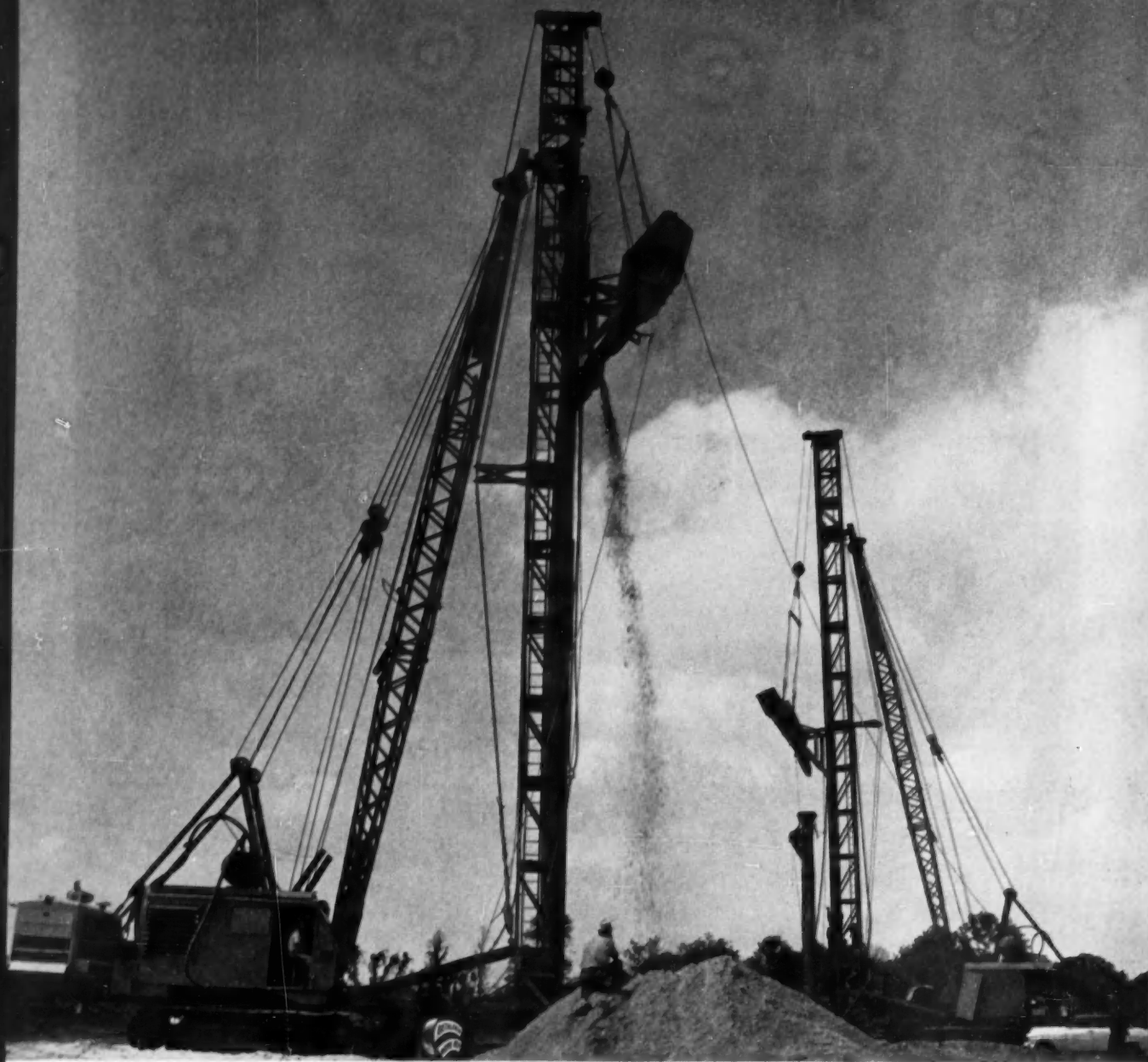


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LA-109



**THE LOUIS ALLIS CO.**  
MILWAUKEE 7, WISCONSIN



**Wire Rope at Work**—In constructing a portion of New Jersey's North-South Freeway, Route 42, the builders were faced with a difficult drainage problem. In boglands near Philadelphia, it was necessary to drive sand drains into the earth, then place cross-drains near the surface and top everything with overburden. The weight of this top layer "squeezed" the bog and forced water up the sand columns and into the cross-drains.

Hercules Concrete Pile Co. contracted to install 500,000 lineal ft of drainage system. The photograph above shows one important phase of the work—filling a casing with sand. The task of ramming the casings into the ground was handled by hard-hitting pile-drivers. To lift the bulky rams for every stroke, the rigs were fitted with Bethlehem Purple Strand—a wire rope so tough that it stood up easily under the merciless demands of the job.

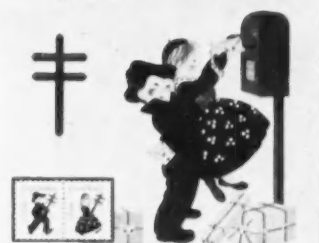
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fight tuberculosis



#### ON THE COVER

**S**HUT your eyes and think of Christmas and many images will pass in review. Somewhere in the procession will be snow, trees and lights. Put them together and you will perhaps come up with some such soothing scene as the one pictured on our cover.

#### IN THIS ISSUE

**L**EADING off is the first of two articles on the Caterpillar tractor, one of the world's best known machines. . . . On the snow-covered Alberta plains, pipeliners are creeping eastward with the Trans-Canada gas line, one of the longest and costliest underground transportation arteries ever projected—page 364. . . . The vault in Bank of America's Airport Branch in San Francisco rests on unstable ground but it can't sink because air-powered jacks keep its floor even with that of the main banking room—page 368. . . . Unusual community Christmas displays in two eastern Pennsylvania cities are described, starting on page 370. . . . Most of the world uses unrefined salt and is perhaps healthier for it. Now this "whole" sea salt is being produced in Texas—page 373. . . . Construction men Guy F. Atkinson of California and Louis R. Perini of Massachusetts will receive 'The Moles' annual awards next February—page 376.

#### ANNA M. HOFFMANN RETIRES

**A**NY errors that may have crept unseen into this issue can likely be ascribed to the absence of Anna M. Hoffmann, associate editor and veteran vigilante of our staff. With 34 years of capable, conscientious and loyal service to look back upon, Miss Hoffmann retired on December 1. Regretfully, we remove her name from the masthead.

# Compressed Air Magazine

© COMPRESSED AIR MAGAZINE COMPANY 1956

VOLUME 61

December, 1956

NUMBER 12

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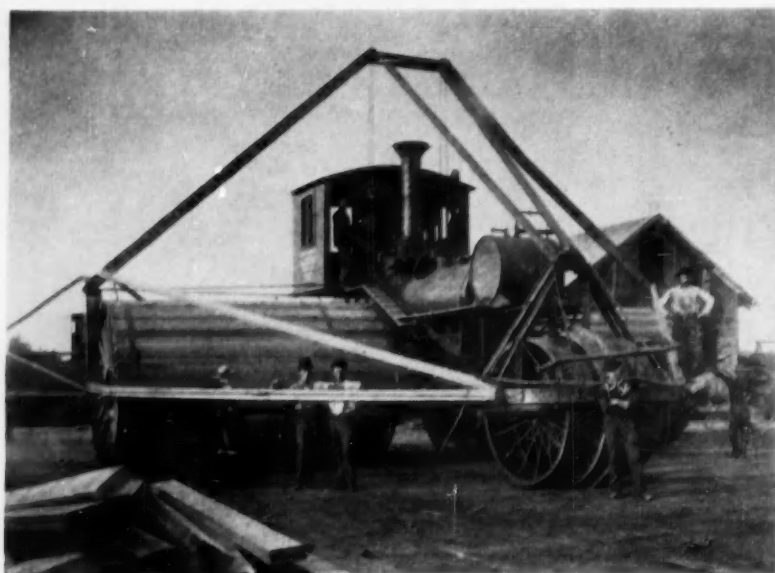
**EPA** Member Business Publications Audit of Circulation, Inc.

Published by Compressed Air Magazine Co., G. W. MORRISON, President  
C. H. VIVIAN, Vice-President A. W. LOOMIS, Vice-President  
J. W. YOUNG, Secretary-Treasurer  
Editorial, advertising, and publication offices, Phillipsburg, N. J.  
New York City Office, 11 Broadway, L. H. GEYER, Representative  
Annual subscription: U.S., \$3.00, foreign, \$3.50. Single copies, 35 cents.  
COMPRESSED AIR MAGAZINE is on file in many libraries and is indexed in Industrial Arts Index and in Engineering Index.

# Caterpillar Tractor Co.

The Familiar Yellow 'Cat' Crawler Tractor Has  
Done Much to Alter the Face of the Earth

R. J. NEMMERS



## BIGGEST OF THE BIG WHEELS

Built by Daniel Best in 1900 for the Middle River Farming Company, of Stockton, Calif., this steam-powered giant weighed 20 tons and had wood-covered drive wheels 15 feet wide and 9 feet in diameter. Most of the men shown were probably needed to operate the rig.

**L**ONG before man first began to record his own history he was concerned with problems of earthmoving—changing, as necessity dictated, the physical aspects of the earth he had inherited. When the idea of the wheel was dimly perceived, the need for roads gave earthmoving a big boost that carried it into our day—into this country with a present Federal-State highway-building program that for sheer magnitude surpasses anything previously attempted.

One of the factors which encouraged our leaders to proceed with a project involving the expenditure of more than \$100 billion was the capacity of American industry to make the necessary machinery, for it would be impossible to undertake such a tremendous job without the giant excavating and roadbuilding equipment we know today. To give generations of earthmovers of days long gone due credit, we must mention such incomparable feats as the construction of the Pyramid of Cheops, the Great

Wall of China and the famed Roman aqueducts. But where it required the labors of thousands of slaves and nearly a lifetime to complete those ancient structures, we build our highways with comparatively few men and in much less time. Moreover, it is almost certain that we will do the work for less money per yard of material moved in terms of relative buying power.

Among the world's best-known trademarks are two used, among others, by Caterpillar Tractor Co.—“Caterpillar” and “Cat.” The big yellow earthmovers that carry these names are to be found everywhere. The firm itself is the largest producer of earthmoving equipment in the world; just last year it joined the exclusive group of manufacturing concerns whose annual sales are in excess of \$500 million. The far-flung Cat empire includes eight plants in the United States and three which are planned or are under construction abroad. At the end of 1955 it employed 34,476 people, and during that year consumed nearly



## CATERPILLAR'S PEORIA PLANT

Largest of the company's eight domestic factories, this one (foreground) has been repeatedly expanded until it now occupies much of the ground below the river and pretty well surrounds a residential area. It provides total floor space of 5,766,000 square feet and employs 27,000 persons. The city of Peoria is on the far side of the Illinois River.

\$300 million worth of raw materials, supplies and outside services in attaining record sales of \$524 million.

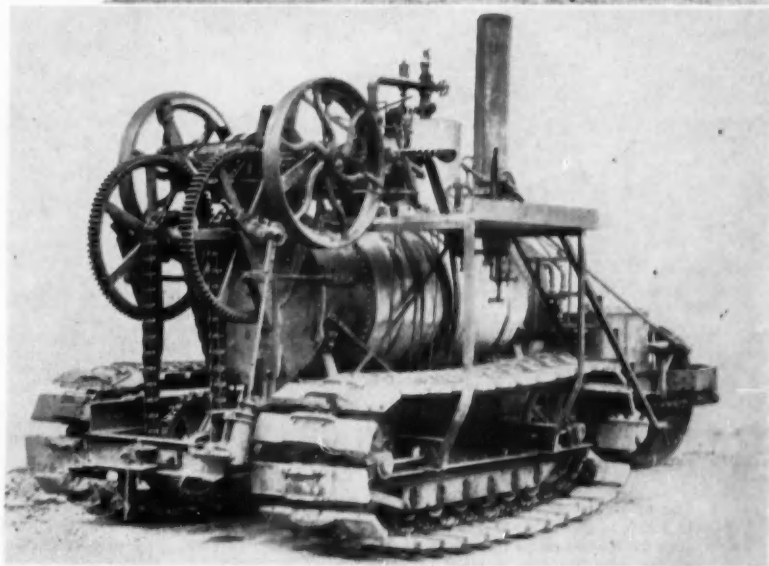
The history of Caterpillar Tractor Co. is essentially the story of this country's experience with earthmoving machines. Although the Cat trademark appears on a great variety of equipment including diesel engines, motor graders, wheeled tractors, etc., the firm is best known for its crawler or track-type tractors. Its identification with big prime movers is not at all strange, for at the turn of the century its two predecessor companies were building some of the most gigantic tractors ever to roll on land. Steam powered, the largest of the behemoths was a creation of Benjamin Holt and was almost 46 feet wide. Each of its six wheels was 7½ feet in diameter and 6 feet wide, the great size being necessary to keep the heavy machine from sinking into the ground. The last word in big wheels, though, was a monster tractor constructed by Daniel Best in 1900. It had two wood-covered drive wheels, each 15 feet wide and 9 feet in diameter. Best and Holt tractors ruled the big-farm market, and the two men were chiefly responsible for the development of the steam tractor.



Best and Holt, both gifted men, began their inventive careers on the Pacific Coast near the great grainfields. They were born and raised in the East and eventually migrated to California, Best finally settling in San Leandro and Holt joining his brother in Stockton. In the beginning, each built combined harvesters, or combines as they are known today, but their inventive genius soon carried them into other fields. They were competitors in the strictest sense of the word and carried on what can only be described as a rip-snorting battle for sales.

In 1889 Best delivered his first steam-powered tractor; a year later Holt made and sold one. But if those two men were largely responsible for the brief rise to glory of the wheeled steam tractor, they were also responsible for its demise. Best was instrumental in ending the day of the steam engine when, in 1896, he sponsored a tug-of-war between his experimental gasoline-engine tractor and an older model Best steam-traction engine. According to the *San Leandro Reporter*, the new model "hauled the steam engine around the block." Holt sounded the death knell of giant wheels in 1904 when he developed and patented the first practical track-laying device. Production began in 1906 and the first crawler sold for \$5500.

The gasoline engine and tracks were combined and led to a revolution in farm motive power. Also, here and there, a few contractors began to use the equipment, and therein lay the future of the two companies. In 1908 they ended their rivalry by merging,

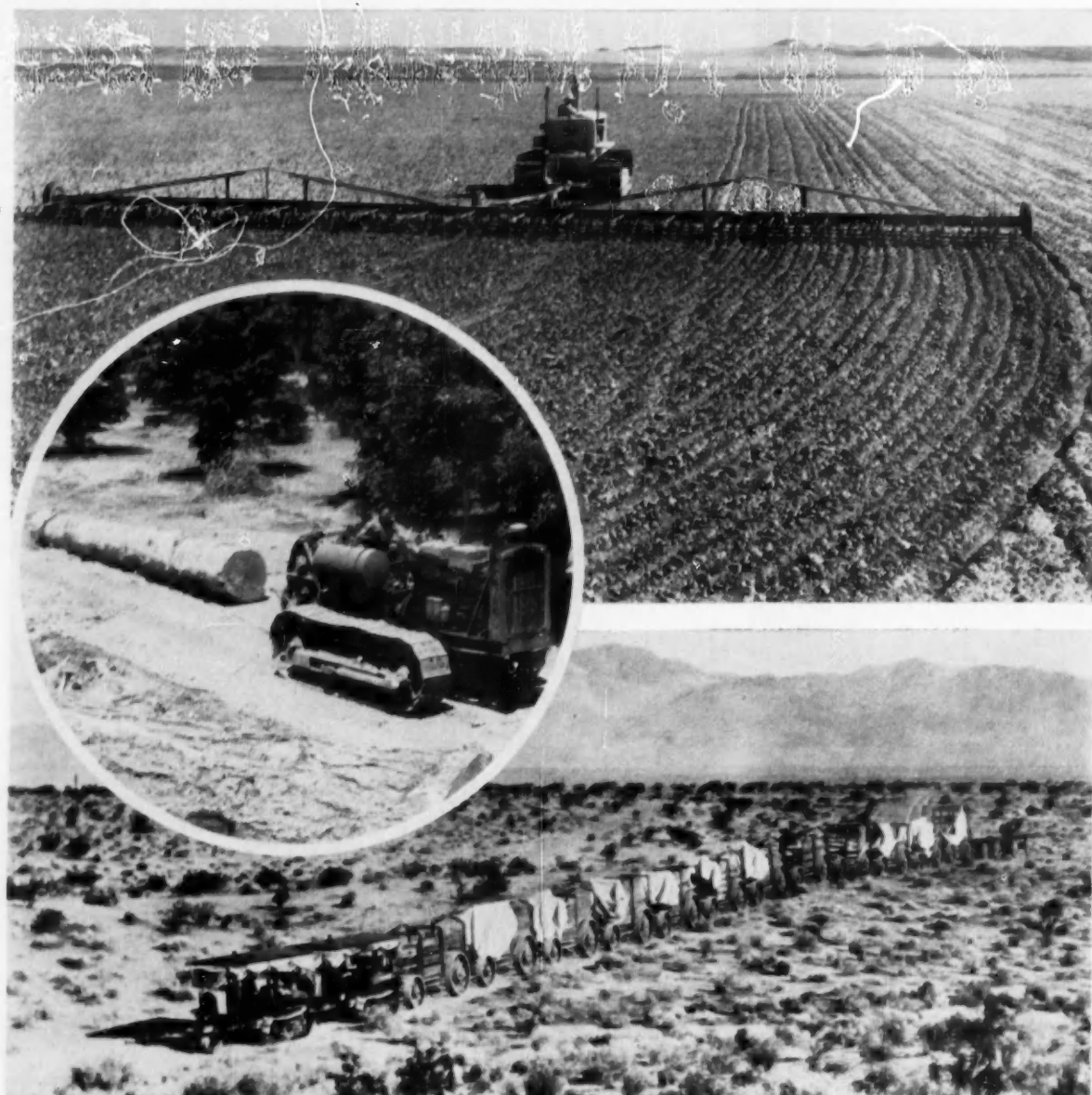


#### FIRST CRAWLER TRACTORS

Holt developed the first practical track-laying device in 1904. Two years later the steam-powered machine pictured just above was placed in regular production. The tracks were made of wooden cross members having malleable iron shoes bolted to their centers. The machine was equipped with power steering. The initial rig was sold for \$5500 to the Golden Meadow Developing Company for use on spongy Louisiana delta lands. Two years later a Holt gasoline-engine-driven crawler appeared and is shown at the top during a hill-climbing demonstration. It had a tiller wheel out in front. Several years later that type of steering device was replaced by steering clutches and brakes applied to the tracks. The horse in the background seems to have been much interested.

but it was resumed only two years later when Best's son formed the C. L. Best Gas Traction Company. In the meantime, Holt had acquired a second fac-

tory in Peoria, Ill., where he had the advantages of excellent rail and water transportation, a trained and ready supply of labor and a more central location.



#### TRACTORS AT WORK

The original Caterpillar diesel-engine-driven tractor, built in 1931, is shown (in circle) still working in 1951 skidding logs on a lumbering operation near Quincy, Calif. Many of the first track-type tractors were used for overland hauling. Two are pictured pulling a wagon train across the Mojave Desert during the construction of the Los

Angeles Aqueduct in 1909. Within three decades tractors took over most of the horse's tasks on farms. The top picture shows one pulling a 60-foot spring tooth cultivator in a Montana field. Caterpillar originally made farm equipment, but in 1935 the last of this business, a harvester line, was sold to John Deere & Company.

By 1910 Holt's Peoria plant employed 65 people earning on an average 25 cents per hour. It seems incredible to us today that the relatively small number of machines built by both firms could have made such an impression on the world. And world renowned they were, for kings and heads of state had seen the tractors in operation and exclaimed over them. Holt, especially, was successful in promoting business abroad.

But Holt, Best and other tractor manufacturers weren't only competing with

one another but had to battle the adherents of old Dobbin, as well. Their weapons consisted of both prose and poetry. Said the Holt firm:

The horse is sliding off the map; his friends at last admit it.

He'll hang around a while mayhap, but soon he'll have to quit it.

For things propelled with gasoline increase each day in numbers.

And Dobbin leaves this earthly scene for his eternal slumbers.

Old Dobbin's advocates kicked back with a little versifying of their own.

I'll let my neighbor fret and stew about the things his tractor'll do;

I'll take old Dan and Kate and Ned, and hitch them to a plow instead.

Let neighbor plow with his machine and raise his corn with gasoline;

My way of farming is the best; I have more time to smoke and rest.

The horse, regardless of the merits of the poetry for or against him, was on the way out. It took only about three decades until the number of acres tilled with either wheeled or track-type tractors surpassed that plowed by horses.

And the revolution, if anything, was even faster on contractors' spreads. At first the gasoline track-layer served as a substitute for animals. A Fresno scraper or other implement was just hitched behind the tractor, with the latter's drawbar taking the place of a singletree. It was not long, however, before engineers began to visualize mechanisms designed especially for use with and mounted on track-type tractors. Bulldozer blades, scrapers, graders, etc., arrived on the scene about that time.

As 1914 drew near and clouds of war hung threateningly over Europe, a British Army Officer, Col. E. D. Swinton, recommended to the then First Lord of the Admiralty, Winston Churchill, that a "land destroyer" based on a Holt track-type tractor be built and armed. Mr. Churchill agreed and backed up Swinton's proposal. The first land de-

stroyers, as Swinton named them, appeared in 1915. Many were constructed in Holt's Peoria plant. Great secrecy surrounded their manufacture — word passed that they were water tanks for troops in Africa. The name "tank" stuck, and when the juggernauts rolled onto the battlefield the German armies were halted and pushed back. Later the British people presented the citizens of Peoria with a Mark IV Tank "in appreciation of the great service rendered Great Britain by The Holt Manufacturing Company during the War."

In the course of the war years Holt had expanded greatly to meet the demands of the Allies both for tanks and tractors. Afterwards, resuming the old rivalry with the Best Company, it was found that the latter had been able to preserve most of its dealer organizations while the Holt distribution network had

fallen apart. Best energetically pushed its advantage and soon obtained a sizeable share of the market—enough seriously to concern the directors of the Holt enterprise whose manufacturing facilities were nearly six times as large. Best, however, was hampered by a lack of working space and machinery.

Harry H. Fair of San Francisco saw an unbeatable combination in the two lines of tractors, and through his efforts the Best and Holt interests were brought together in 1925. The already well-established Holt trade-mark—Caterpillar—was retained by the new firm, to which each company contributed in full measure. The Holt name was, of course, invaluable, and its reputation did much to insure the success of the organization. Best provided a sound financial structure and, perhaps, the better tractor design at the time. The Holt facilities at Peoria and Best's San Leandro plant were operated by the new firm. Mr. Fair became a member of the board of directors and served until 1954, the last three years as chairman. That same year Harmon S. Eberhard was elected president of Caterpillar Tractor Co. He had joined the Holt Company in Stockton in 1916, and during the intervening 38 years had worked first as draftsman and then in various other capacities.

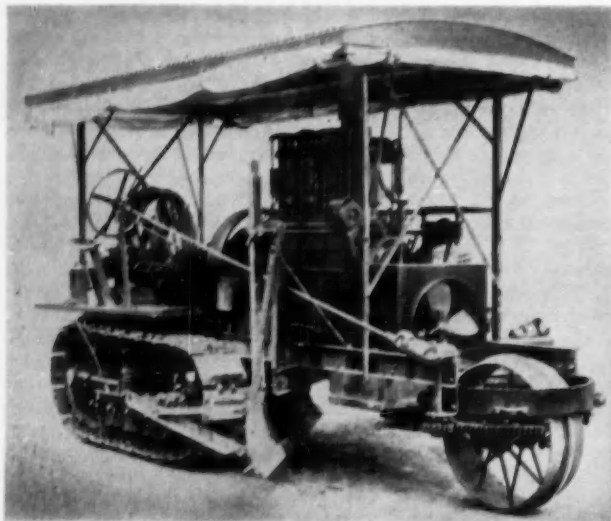
Business boomed. The combined line of tractors and farm implements sold well, and as designs were improved and technical advances made prices dropped more and more, bringing the products within reach of thousands of additional users. Federal aid for roadbuilding had started in 1921 with the Highway Act, and the contracting trade proved to be a lucrative market for tractors. New types of bulldozers, scrapers, graders, etc., began to appear. Each failed or succeeded on the strength of its capacity to move dirt faster or cheaper. Then came the depression, and the wheels of industry slowly ground to a virtual halt. However, something was brewing in the research department at Caterpillar's Peoria plant that was to alter the course of the "poor years," so far as Caterpillar was concerned.

Tractor number 1C1 went to work in 1931. There was only one major difference between it and the machine the company had sold previously—it was driven by a diesel engine. By 1933 the firm's production of diesel horsepower equaled that of the entire nation during the preceding year. Nearly all the engines went into tractors. Old number 1C1 had done its job well—it had revolutionized the construction industry, which virtually runs on diesel fuel today. Even during the depression the new tractors sold like the proverbial hot cakes. Soon the demand for construction equipment far surpassed the agricultural phase of the business. In 1935 the department of the Caterpillar Tractor Co. that had



#### CATERPILLAR IN TWO WARS

A model 75 tractor is shown in the upper view towing a howitzer on the Western Front in 1918. Twenty-five years later Caterpillar machines went to war again. With its blade raised to protect the operator from frontal gun fire, a D4 tractor is pictured moving along with infantry on New Guinea. Admiral William F. Halsey said the tractor-bulldozer was one of four machines that won the war in the Pacific.



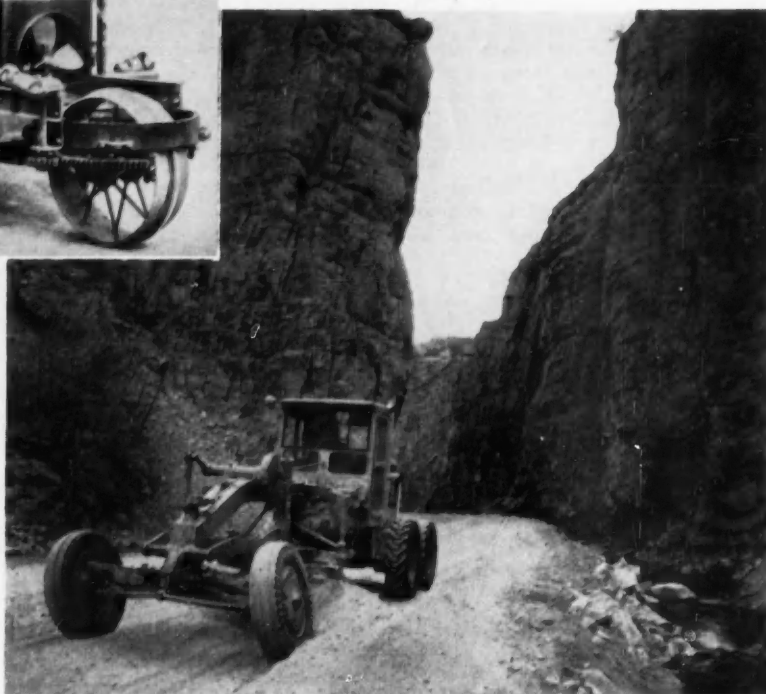
#### GRADER EVOLUTION

Tractors were first used as substitutes for animals and pulled separate implements. Several years elapsed before engineers conceived the notion of mounting equipment right on the tractor. The result of one of their first attempts is shown at the left. It is a Holt tractor-grader combination built in 1910. Below is shown a modern Caterpillar motor-grader in action in Utah. It represents an extreme in specialization of earth-moving equipment in which the prime mover is somewhat subordinated. Normally the attachments can be mounted or demounted with relative ease, or towed behind or pushed by an independent tractor.

continued to turn out the old line of Holt harvesters was disposed of—John Deere & Company was licensed to take over the work. Cat facilities were devoted to the manufacture of tractors, motor graders and diesel engines. Employment at Peoria soared to more than 11,000 in 1936, nearly 4000 more than the predepression peak in 1929 and about 8000 more than in 1931.

By 1940 thirty percent of Caterpillar production was being shipped overseas to the Allies, the bulk of it for military construction. During 1941, even before the United States entered the conflict, virtually 100 percent of its output was slated for defense work. Early in 1942 the firm converted to war supplies—howitzer carriages, shells, bomb parts and engines and tracks for tanks. A new company was formed—the Caterpillar Military Engine Company—and a factory was built in Decatur, Ill., to house it.

Then, in 1943, with the war still raging, Caterpillar was called upon to reconvert—to go back to making its pre-war products. The island-hopping campaign in the South Pacific had started. "Take an island; slap roads and an airstrip on it; regroup; and leave it behind," was the order of the day—a pattern that was repeated almost endlessly on the slow crawl back across the Pacific. In the forefront of the attack were tractor-bulldozers, which often landed on an enemy-held island with the first wave of attacking troops. They pushed and plunged their way through the dense tropical growth and left roads and airfields behind. After victory was won, Admiral William F. Halsey had this to say about the role of earthmoving equipment: "The four machines that won the war in the Pacific were the submarine, radar, the airplane and the tractor-bulldozer."



Because it was already operating on a peacetime basis, Caterpillar had to change only the color of the paint on its equipment from olive-drab to the familiar yellow at the end of hostilities. The greatly expanded facilities were loaded to capacity in order to catch up with the demand for its products. Many of them were allocated or rationed during that period. The company also decided to expand its lines. As early as 1944, Caterpillar officials announced a plan to construct a complete set of matched earthmoving equipment. Today the list includes scrapers, wagons, rippers, bulldozers, tractor shovels, tool bars and cable and hydraulic controls. The 1925 line consisted of only five machines—all crawler tractors. Through the 1920's and 30's accessory equipment was made by other companies and more than 80 of their products were listed in Cat sales literature.

After 1936 manufacturers began to specialize—to build accessories specifically for a given make of tractor. That led, of course, to the present trend where by much of the equipment which is hung

on the front or back of a tractor, or which is towed behind it is engineered and designed to match its power characteristics. Often the accessories are turned out by the tractor manufacturer himself, as is the case with Caterpillar today. One of the first combinations of the kind in the Caterpillar line was the rubber-tired wheeled tractor and accompanying wagon produced in 1940.

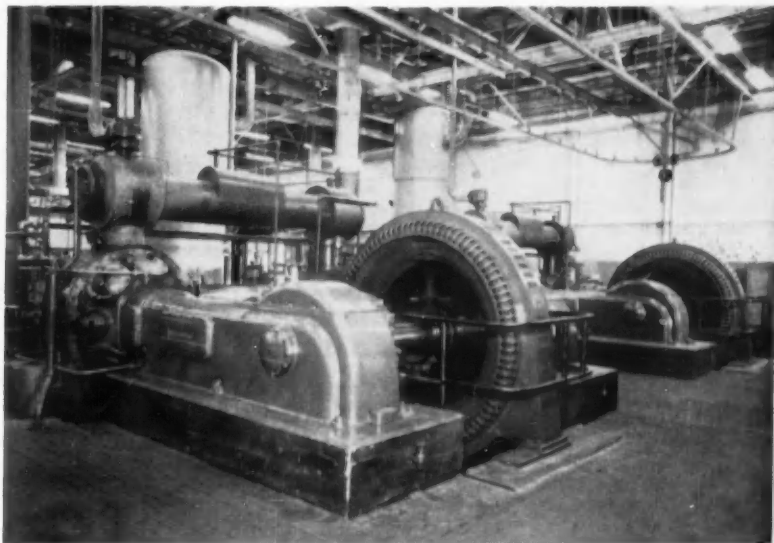
Perhaps the most specialized of all crawler-tractor accessories are designed for pipe-line construction. In 1951 Caterpillar acquired the Trackson Company of Milwaukee, Wis., thus adding that firm's line of pipe layers and high-lift shovels to its own. Trackson was formed in 1922 and began to make tractor equipment in 1928. Its first unit for Cat track-type tractors—an attachment for pipe laying—appeared in 1936. A year later a high-lift shovel for Cat-built tractors was introduced.

Entrance of Caterpillar into the tractor-equipment field and its efforts to catch up with the demands of contractors and farmers the world over has been an expensive business. More than

\$200 million was spent on capital improvements in the decade following the war on two big plant additions in Peoria, new factories in York, Pa., and Joliet and Decatur, Ill., as well as for the Trackson Company. Nearly \$7,000,000 has been invested in subsidiaries in Great Britain, Australia and Brazil, and more than \$3,000,000 has been placed in the hands of the Caterpillar Credit Corporation, a lending agency set up to help dealers and purchasers of Cat equipment.

Some of the money was used to introduce the biggest track-type tractor ever built—the 28-ton D9. The decision to make the huge yellow machine involved such extensive revisions of plant layouts that it was necessary to construct a new factory, thus promoting the company's program of decentralizing its operations. The plant at Decatur was built to house the new line of earthmoving equipment—to take it out of Peoria and make room for the D9 assembly line.

Today, each factory is devoted to certain products in the Caterpillar line. Peoria, which once turned out nearly all of them now makes only diesel engines and track-type tractors. Joliet, of course, manufactures earthmovers, while Decatur is given over to motor graders and wheeled tractors. The latter plant began limited operations in 1955; it has been run at full capacity since the middle of this year. The San Leandro factory (new buildings on the site of the old Best establishment) makes only diesel-fuel injection equipment. Milwaukee's Trackson facilities, as we have said, produce pipe-line equipment and



#### PEORIA COMPRESSED AIR SUPPLY

Part of Caterpillar's 12-machine compressor plant at Peoria. Each of the two Ingersoll-Rand units shown has a capacity of 3330 cfm and is driven by a 700-hp Westinghouse synchronous motor. Air is discharged at 100 psi, cooled in I-R aftercoolers, then goes to receivers visible in the background and thence into the plant air distribution system. Total compressor capacity at Peoria is 30,760 cfm.

tractor shovels, while the York plant turns out replacement parts.

Especially designed for its role in Caterpillar's operations, the York factory is an indication of the company's policy that there shall be no "orphans" in the Cat family—that no Caterpillar machines no matter how old, even old-time Holt and Best harvesters and tractors,

shall be without replacement parts. To further this aim, Caterpillar recently purchased Englehart Manufacturing Company, of Davenport, Iowa. That firm has been making noncurrent parts and will now devote its entire capacity to this phase of the business. Spare parts are shipped to special departments in Denver, Colo., York, Peoria and Joliet, as well as to ten other strategically located emergency depots throughout the United States. (Early in 1958 the Peoria parts division will be moved to Morton, Ill.)

The latest addition to Caterpillar's facilities is situated in Aurora, Ill., where D2 and D4 tractors and Traxcavators of corresponding sizes will be built. Last May the company decided also to increase its manufacturing space in the Peoria plant, and Caterpillar Tractor Co., Ltd., began the construction of a factory in Glasgow, Scotland, this year.

The eight United States plants have a total floor area of more than 9,000,000 square feet; the one at Peoria, with 5,766,000 square feet, is by far the largest—is bigger than all the others put together. In excess of 27,000 people working three shifts answer the starting whistles. More than 5000 pneumatic tools and hoists are in service there and consume 25 million cubic feet of air on an average day.

A second article, to be published in January, will describe the compressor plant at the Peoria factory and the various ways in which air power is utilized in the manufacturing operations carried on there.



#### D2 AND BIG BROTHER

The smallest and largest Caterpillar track-type tractors. At the left is the D2 and, towering above it on the right, is the 28-ton D9, biggest of the Cat-built crawlers. For all of its weight, the pressure per square inch on the ground under the tracks is little more than that under the feet of an average-size man.



#### ROUTE OF ALL-CANADA LINE

Showing connections with U. S. border in the western and eastern portions, through which gas will be exported. Construction is under way between Burstall and Winnipeg. The line will start as 34-inch, then drop to 30-, 24-, and finally 20-inch.

## Trans-Canada Gas Line

2250-mile Artery Will Transport Alberta Fuel to Eastern Provinces With Connections to the United States

ALLEN S. PARK

ONE of the longest and costliest pipelines in the world is being built in Canada by Trans-Canada Pipe Lines Limited. Designed to transport natural gas from the western province of Alberta to the mining and industrial areas of Ontario and Quebec provinces, it will extend eastward for 2250 miles from the Alberta-Saskatchewan border to Montreal. Branch lines will run south from near Winnipeg to the U. S. boundary near Emerson, Man.; from near North Bay, Ont., to Sudbury, Ont.; from Toronto, Ont., to Niagara Falls, N. Y. (already operating); and from Morrisburg, Ont., to Ottawa, Ont. The estimated cost of \$375 million ranks the project among the largest of the Dominion's all-time construction undertakings.

The line will serve areas having a total population of approximately four million—about one-third of all Canadian residents. Some 65 percent of the potential market for gas is in eastern Canada, with the heaviest load concentration in the industrialized sections of the Toronto-Montreal belt and in southern Ontario. Much of the gas is earmarked for processing operations as distinguished from heating duty. All told, about 200 municipalities will be served. Up to now, only Alberta communities have had natural gas from Canadian fields, but gas originating in the United States is

now reaching Toronto via a line from Niagara Falls. The link is leased to Consumers' Gas Company, which is distributing the gas and thus building up a market in the Toronto section in advance of the arrival of Alberta gas. The American gas reaches the border through the network of Tennessee Gas Transmission Company, of Houston, Texas, from which Trans-Canada has contracted to purchase up to 90 million cubic feet daily.

When the Canadian line has been completed, the Niagara-Toronto line will revert to Trans-Canada, which will then reverse the flow through it to send Alberta gas into southwestern Ontario. Tennessee, in turn, will buy from Trans-Canada, at the international boundary at Emerson, up to 200 million cubic feet of gas daily and has an option to increase the volume to 400 million cubic feet. All of this gas will represent surplus in excess of the quantity required to fulfill Trans-Canada's commitments north of the border. Tennessee plans to build a line from Emerson to Nashville, Tenn., to tie into its American system.

Including the gas to be sent into the United States, Trans-Canada has contracted for delivery of approximately 600 million cubic feet daily in the fifth year of operation and will likely increase



#### PRAIRIE PARLEY

From the left: E. J. Mahoney, vice-president, pipe line construction, Bechtel Corporation Limited; C. S. Coates, vice-president and general manager of Trans-Canada Pipe Lines Limited; and Premier E. C. Manning of Alberta, photographed while on a field inspection trip near Moose Jaw, Sask.

this by 100 million. This would bring the total throughput to well over the 500 million cubic feet daily that the line was designed to carry, but the changes necessary to enable it to increase its capacity could readily be made.

One of Trans-Canada's largest sales contracts is with Union Gas Company of Canada Limited, of Chatham, Ont. This firm has underground storage facilities in Ontario that will be filled in summer and drawn upon in winter, thus helping to iron out seasonal variations in the transmission load. The Province of Alberta has so far authorized Trans-Canada to export up to 620 million

cubic feet of gas daily, aggregating 4.35 trillion cubic feet over a period of 25 years. Alberta's gas reserves are estimated at 16.5 trillion cubic feet.

The line's supply of gas will come from nine or more fields that contain reserves estimated at 5.32 trillion cubic feet. The largest of them is the Pincher Creek, which is expected to yield 3 trillion cubic feet. The fields are of several different types. Some yield condensate with the gas, which will have to be treated for removal of propane, butane and other materials before it enters the line, and plants will have to be erected for that purpose. In other fields the gas is produced with oil and the wells are assigned monthly oil-production quotas that may be filled in as few as 20 days. In such cases, other sources of supply will have to be drawn upon to maintain a consistent flow of gas. The remainder required will logically come from fields yielding dry gas, which needs little or no pretransmission processing. The gas from the various sources will be gathered and delivered to Trans-Canada at the Alberta-Saskatchewan boundary by The Alberta Gas Trunk Line Company Limited, which was organized in 1954 by the Alberta Government.

Five years was required to bring the project to the construction stage. Trans-Canada Pipe Lines Limited was incorporated in March 1951, as a subsidiary of Canadian Delhi Oil Ltd., an exploration company that was searching for oil and gas. In January 1954, Trans-Canada merged with Western Pipe Lines, which had been formed by Canadian business men. In November 1955, Tennessee Gas Transmission Company acquired a one-third interest in the enterprise and in February 1956, Canadian Gulf Oil Company (now British Amer-

ican Oil Company Limited) and Hudson's Bay Oil and Gas Company Limited joined in its ownership. Canadian Delhi and Western Pipe Lines now each own 24½ percent and the three other participants have 17 percent each.

In May 1954, Trans-Canada received permission from the Alberta Government to export gas and in July of that year the Canadian Government's Board of Transport commissioners issued it a permit to construct the line across the southern portion of the Dominion. Negotiation of contracts for sales of gas was then begun. Arrangements for financing were contingent upon the signing of these agreements and all of them

could not be completed in time to start construction in 1955, as had been requested by the Canadian Government.

To help break this impasse, the governments of Canada and of the Province of Ontario agreed to build the Ontario link of the pipeline themselves and lease it to Trans-Canada with an option to purchase. The Northern Ontario Pipe Line Crown Corporation was formed for the purpose. However, it was desirable to start the construction at the western end and to make this possible the new corporation announced, early in 1956, that it would advance \$72 million towards laying the line from Burstall, Sask., to Winnipeg and a bill authorizing

#### PARADE OF THE MECHANICAL MONSTERS

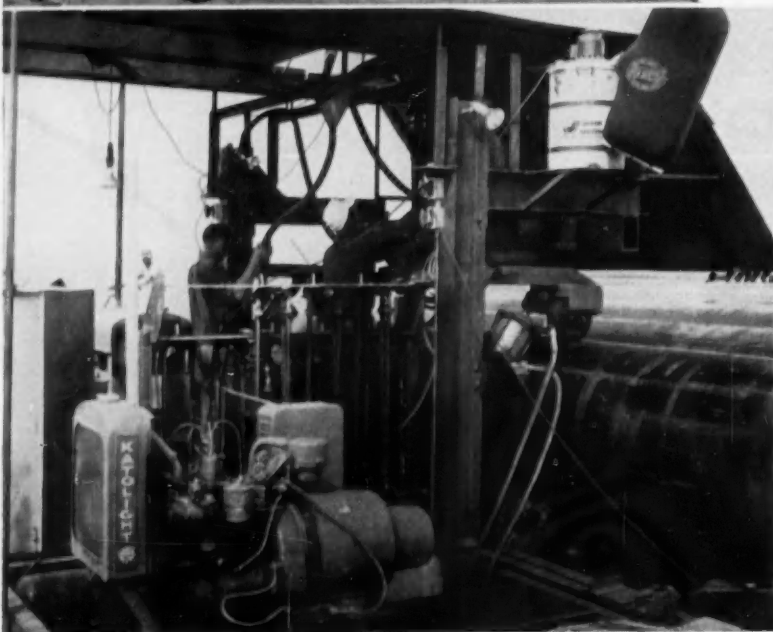
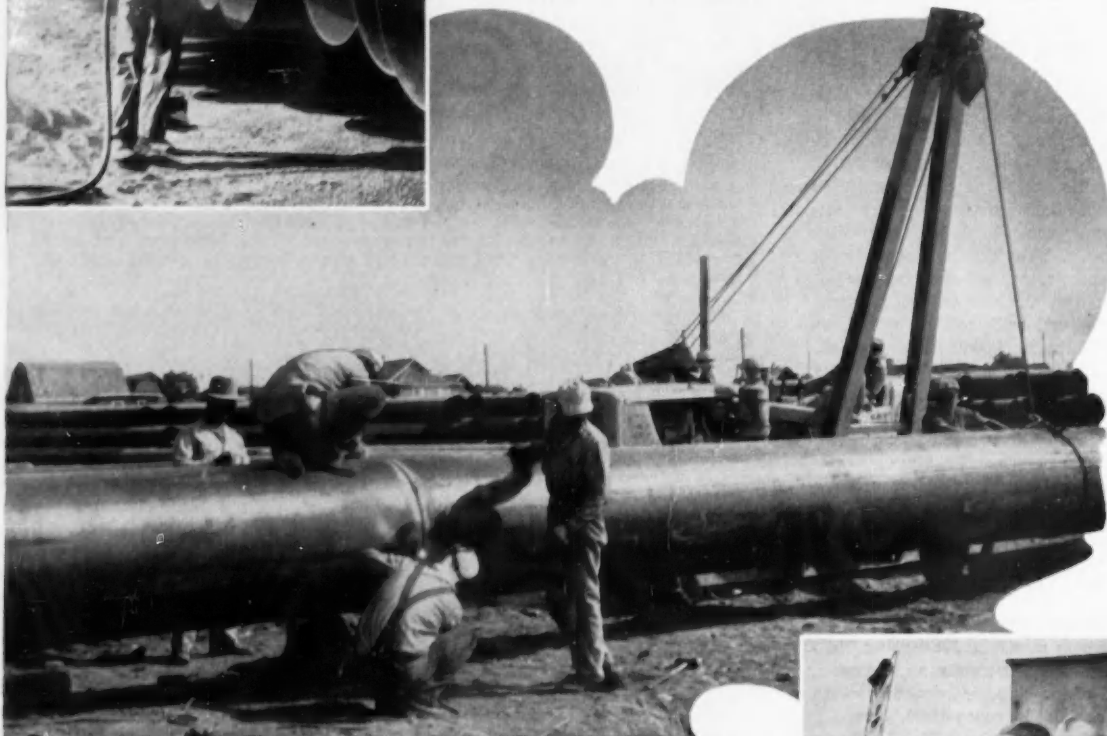
A ditch 6 feet deep and more than 3 feet wide is cut through the Saskatchewan prairie (upper picture) at the rate of 1½ miles a day. Pipe lengths are then welded into a continuous string preparatory to placing it in the ground. While side-boom tractors hold it up, the coat-and-wrap machine (bottom picture) applies coal tar "dope" to prevent corrosion, then wraps it with fiber glass and kraft paper. The cradling-in gang immediately lowers it into the trench, which is then backfilled.





#### DOUBLE-JOINTING OPERATIONS

To expedite pipe laying, Canadian Bechtel Limited made up 80-foot lengths from two 40-foot ones before delivering them to the right of way. The first step was sand-blasting of the beveled edges of the pipe ends (left). Next, two lengths were placed end to end by side-boom tractors and held in line by pneumatic interior clamps while welders placed the first or "stringer" bead of weldment (center). After more metal had been added to the bead in the "hot-pass" area, the job was completed by a Lincolnweld submerged automatic welder (bottom left). By pushing buttons the operator controls the turning of the pipe as it is welded, then shunts it sidewise to the X-ray rack and maneuvers another section into welding position. All of the operations are basically air-powered. At the lower right an inspector for the pipe line company and an X-ray technician check an X-ray negative. If faulty welds are revealed, they are cut out.



the action was enacted by the Parliament at Ottawa. This paved the way for the letting of the first contracts for pipe and construction. The money advanced is to be repaid, with interest, by next spring and will then be used by the Crown company to help build the Ontario link

The Burstall-Winnipeg leg will consist of 574 miles of 34-inch pipe, of

which 203,700 tons was ordered from the National Tube Division of U. S. Steel Corporation and A. O. Smith Corporation at a cost of \$35 million. The Winnipeg-Toronto section will use 1263 miles of 30-inch pipe. The latter, totaling around 480,000 tons, is being manufactured by Welland Tube, Ltd., of Welland, Ont., with a \$45-million order, and South Durham Steel & Iron Company, of England, with a \$32-million order. The Toronto-Montreal link will require about \$9 million worth of 24- and 20-inch pipe. Freight charges on the pipe and necessary valves are estimated at \$8 million and sales taxes at \$11 million, which will bring the over-all expenditure for this material to approximately \$140 million.

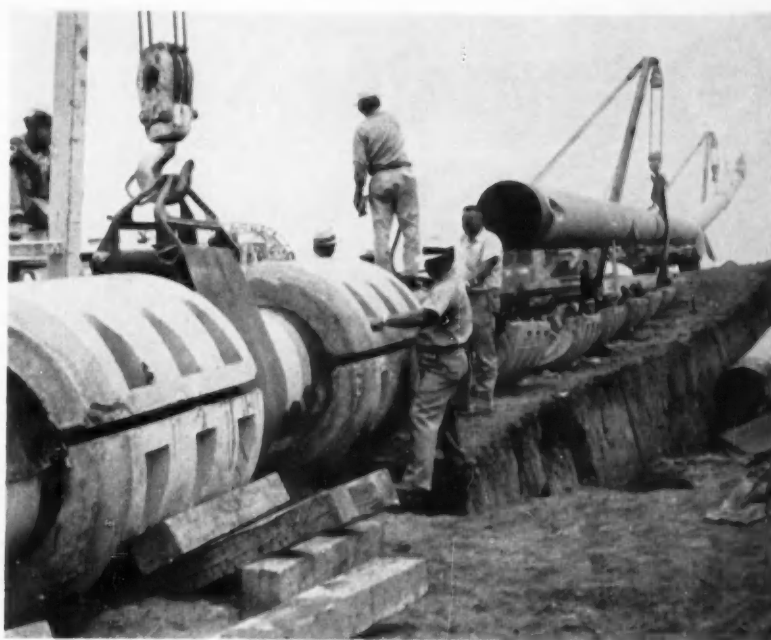
From Burstall to Winnipeg the terrain to be crossed is mostly rolling prairie in pasture or under cultivation. There are few streams but numerous sloughs. There is little rock. In western Manitoba the surface is flatter and heavily timbered and there are scattered boulders. In western Ontario the topography is rougher and almost 70 percent of the ditching will involve rock drilling. From there on eastward the line will pass through rolling country, grasslands with light muskeg, swamps and lakes, with rock excavation required on from 35 to 50 percent of it.

The first construction contracts, covering four of the six "spreads" com-



#### CLOSE-UP OF WELDERS

Line welders on "Spread No. 1" joining pipe in the field. They have to wear heavy protective clothing in addition to masks and gloves and they found the heat oppressive during the Saskatchewan summer when this picture was taken. Recently, however, the crews have been working in snow and with temperatures so low that the ground thaws out for only a couple of hours during the day.



#### CONCRETE RIVER WEIGHTS

Concrete girdles, each weighing 6000 pounds, are placed around the 34-inch pipe to hold it down where the line passes through swamps, lakes or rivers. At this water hole near Chaplin, Sask., about 30 weights were applied before the line was lowered into the ditch and buried.

prising the Burstall-Winnipeg section, were let during the past summer. From the western end eastward, the contractors are: Majestic Contractors Limited, Edmonton, Alta.; Canadian Bechtel Limited, Toronto; Mannix Limited, Calgary, Alta.; and Dutton-Williams Bros., Calgary. The first two concerns mentioned got on the job immediately and, after completing preliminary work of clearing right of way, etc., have been laying more than 1½ miles of 34-inch pipe daily, which is as fast as somewhat smaller pipe is normally put in place. Up to October 18, they had jointly put about 160 miles of pipe in the ground, backfilled the trench and cleaned up behind them. Total length of the two spreads is 210 miles. The two other contractors were delayed in getting on the job because of a pipe shortage occasioned by the strike of steel mill workers in the United States, but they are now actively at work.

A time-saver for Canadian Bechtel was a "double-jointing" yard where 40-foot lengths of pipe were joined into 80-foot sections prior to being delivered along the right of way. This procedure was adopted to reduce the amount of welding and pipe handling required in the field. It also permitted using an automatic welding technique and the shelter provided at the yard allowed work to proceed regardless of weather conditions. Several of the operations were air powered. The yard was initially set up 40 miles east of Swift Current and later

moved eastward as the work progressed.

Forty-foot lengths of pipe were unloaded from railway cars and hauled to the yard by heavy tractor-trailers. The first operation at the yard was to sandblast the beveled edges of the pipe to remove protective coating put on at the steel mill. Two lengths were then lined up by side-boom tractors and held by pneumatic internal clamps while the first or stringer bead weld was applied. Thus joined, the 80-foot member was rolled to the "hot pass" area where welders, each aided by two assistants, added more metal to the bead.

The pipe was then moved to a Lincolnweld automatic submerged-arc welding machine powered by two 600-ampere generators. There, as the pipe was revolved slowly, wire from two reels was applied to finish the weld. The pipe was then automatically rolled away to make room for another one. Completed 80-foot sections were X-rayed, inspected by a Trans-Canada representative, then loaded on a huge tractor-trailer for delivery to the right of way.

As soon as the first link of the line is finished Trans-Canada expects to start delivering 21 million cubic feet of gas daily to Winnipeg, a city of some 375,000 population. No compressor stations will be required initially as well pressures are high enough to force the gas through the line to Winnipeg. As the line is extended, a sufficient number of compressor stations will be provided to meet the delivery demands.



#### CLOSE-UP OF JACK

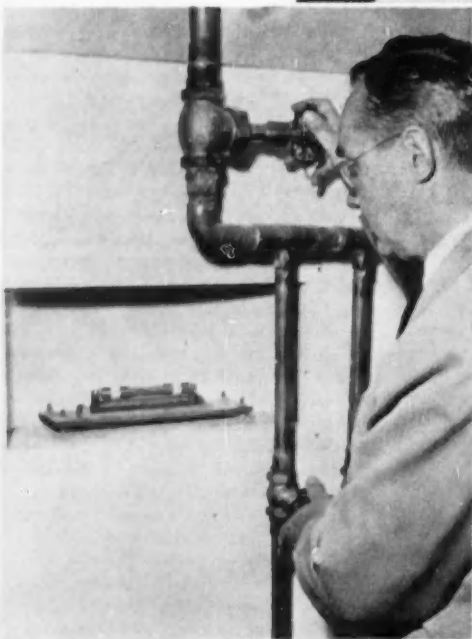
One of the four Duff-Norton air-powered jacks in place under a corner of the 150-ton vault. The headroom is 26 inches.

**A**IR-OPERATED jacks are being used in a unique California installation to keep a 150-ton bank vault from sinking into unstable ground. The location adjoins the new San Francisco International Airport, on San Francisco Bay, where buildings not supported on piling are expected to settle 20 inches during the next four decades.

The area, once tidelands and marsh, was filled in with six to eight feet of compacted earth so that firms serving the heavily populated upper portion of the San Francisco Peninsula could locate near the new Airport Terminal building. The spongy ground, made worse by rains and the pressure exerted by new structures, created knotty problems for contractors. Possibly the worst situation of all was encountered by Bank of America in planning its branch office there. A soil investigation showed that over a 40-year span the bank's heavy vault might be expected to settle 10 inches more than the rest of the building.

It was predicted that this would likely occur even though, as was recommended for all structures except the Terminal itself, the branch office was to be constructed on top of a concrete mat. The outlook was not promising. The vault could twist away from the remainder of the building or, if that didn't happen, it could sink so much more than the banking room that one day it might be impossible to open the massive 3½-ton steel door.

Through its building agent, Continental Service Company of San Fran-



#### MOVEMENT INDICATORS

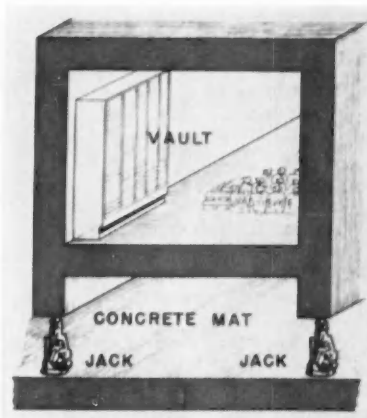
Matchmarks on the adjoining vault and building walls (upper right) immediately show any variation in the rates of settlement of the two structures. Spirit levels set in a vault wall (above) also reveal any tilting or shifting of the vault. In either case, the trouble can be corrected by admitting compressed air to one or more of the jacks by turning the appropriate valve.

## Bank Vault

## 'Floats'

## On Air Jacks





#### LAYOUT SKETCH

Diagram shows arrangement for jacking up vault to compensate for settlement and keep its floor even with that of the banking room.

cisco, Bank of America adopted a daring scheme to overcome the difficulty. It decided to "float" the vault by using jacks. After studying available lifting devices, Continental's specifications department elected to do the job with air-powered jacks manufactured by Duff-Norton Company, of Pittsburgh, Pa. Each jack weighs 448 pounds, stands 26 inches high, has a base diameter of 13 inches and a head diameter of  $6\frac{1}{8}$  inches. Each can raise a 75- to 100-ton load 14 inches in a few minutes. The jacks employ the time-tested basic screw principle with built-in rotary air motors.

To use the jacks most effectively, the vault was built separately from the

#### EXTERIOR OF BUILDING

San Francisco Airport Branch of Bank of America, one of numerous commercial structures erected on filled ground that occasioned construction headaches.



building proper and on an individual concrete mat but in such a way that it adjoined the main structure on two sides. The mat or "raft" under the vault was designed for a soil pressure of 444 pounds per square foot and the one under the other part for 150 pounds.

Here's how the firm of Johnson and Mape, of Menlo Park, Calif., placed the jacks under the vault:

First, the concrete mat, the exact size of the vault base, was laid. Then a concrete box was poured on top of the mat with sufficient height to permit the jacks to operate within it. Next, a jack was set in each of the four corners of the box. Then an 18-inch-thick reinforced concrete floor for the vault was poured just above the tops of the jacks. On the floor, 18-inch vault walls and ceiling were erected. An equipment room to house an air compressor and related machinery was constructed on top of the vault. The compressor installed there is an Ingersoll-Rand Type 30 two-stage, air-cooled

machine belt-driven by a 5-hp motor.

Control valves inside the vault regulate the flow of compressed air to the jacks, each of which is served by a separate pipe line. Air is discharged from the compressor at 230-psi pressure but is reduced at a valve to reach the jacks at 90 psi. Two spirit levels set into the vault's concrete walls—one on each side of the control valves—enable bank officials to tell at a glance when the vault has shifted. A turn of a valve activates the jacks and returns the vault to the desired position. "Matchmarks" inscribed on the bank wall and vault wall facing the main banking room also indicate level changes.

So far the vault has subsided about one inch more than the rest of the structure, which is in line with the engineers' calculations. The jacks have equalized the variation. Imaginative planning and husky air jacks are literally keeping funds at this branch of the world's largest privately owned bank from going underground.

#### Story of Outstanding Contractor

**A**LTHOUGH he died more than 20 years ago, Patrick McGovern is still remembered by many construction men as an outstanding contractor whose success was the more remarkable because the man had virtually no formal engineering education. His interesting life story is told by J. L. Allhands, himself a veteran contractor, in a recent issue of *America's Builders*, a monthly publication of George Pepperdine College, Los Angeles, Calif.

Within seven years after he arrived alone in Boston as an almost penniless Irish lad of 21 years, McGovern was running his own contracting business. He first obtained work laying granite blocks on the cobblestone streets of Boston and got a lucky break in 1895. Boston was then building America's first underground street railway, with Charles R. Gow as resident engineer, Arthur E. Weaving as night superintendent and Charles R. McCarty as timekeeper. One night Weaving asked Gow to have a granite paver available the following night to replace blocks on a street that had been torn up. Gow forgot about it until the next evening when he happened to notice McGovern, on his way home from a day's work, carrying a paving hammer. McGovern was persuaded to come to work at 7 o'clock that night and that was the beginning of a long friendship among the men mentioned. In fact, the others all worked for McGovern in later years.

McGovern began contracting with a \$3236.54 job of cobblestone paving in Boston in 1898. He went on to handle an estimated \$175 million worth of underground work alone. His first tunnel job was the driving of the East Boston bore in 1903. He then got into subway work,

first in Boston, next in New York in 1912 and later in Philadelphia. Early in his career he established a reputation for getting jobs done quickly and this characteristic reached a climax in New York when he completed a \$22-million subway link from 53rd Street and 8th Avenue in Manhattan to the Borough of Queens two years ahead of schedule.

In 1928 he contracted to drive 22 miles of deep tunnel under New York City to carry Catskill water. The \$46-million job, on which 3000 men were employed, is said to have been the biggest ever let to an individual.

McGovern survived the 1929 crash practically unscathed, thanks to having followed the advice of Albert Wiggins, then head of the nation's largest bank, the Chase National. McGovern had become friendly with Wiggins through years of arranging credit for financing his operations. When he sought the banker's counsel on investments, Wiggins said: "If I were you, I would invest in McGovern." The contractor consequently kept his money for use as working capital and lost none of it.

When he was starting out, McGovern was sometimes hard pressed for funds. Once several firms refused to sell him cement on credit, but an agent named J. P. O'Connell trusted him. McGovern not only paid the bill promptly, but always thereafter bought his cement from O'Connell, who became wealthy as a result.

For years McGovern also obtained his work performance bonds from a Boston firm with which he started. In later years, however, he often had no need for bondsmen; he merely deposited enough United States bonds to guarantee that he would carry out his contract.

# Community Christmas Displays

Municipal Decorations Add Greatly to Our  
Appreciation of the Holiday Season

ROBERT JAMES



## A HUGE CANDLE GLOWS IN THE NIGHT

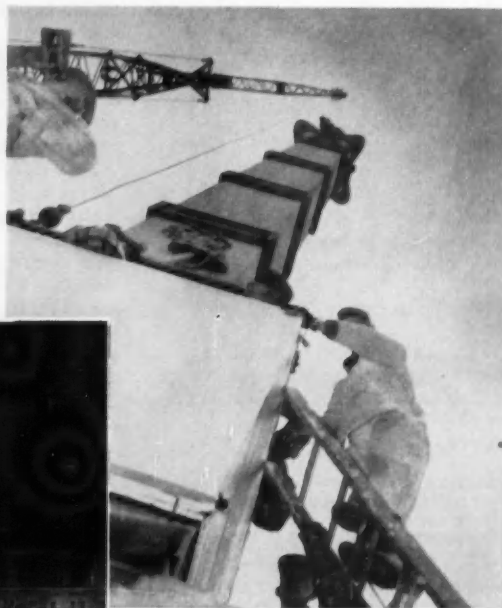
Centre Square (or circle), where Easton's candle is erected each December, is typical of practically all Pennsylvania cities. As is usual, it is at the intersection of the two principal streets and in the heart of the business district. During most of the year, it is the site of an open-air farmers' market on several mornings of each week. Easton has a population of 35,600 and is the seat of Northampton County. The road signs in the foreground point to Bethlehem, 11-miles away.

**I**N MOST American cities the townspeople join together in commemorating the Birth of Christ. Some communities express the mood of the season by erecting displays—a star, a giant tree or candle or a well-planned city-wide decoration of light standards, bridges and the like. Some are dedicated, for example, to the memory of the community's war dead; others are simply decorative. However, all enhance the joyous Yuletide spirit and add materially to our understanding of the basic meaning of Christmas.

Some decorative schemes are so elaborate that many specialized skills and services are required to bring them to reality. Members of local manufacturers' engineering staffs are frequently called upon to design the structures; the community's construction firms make their equipment available; commercial artists and sign painters and designers lend their talents; and labor unions furnish skilled craftsmen and erectors. The

man on the street, the merchants and others are asked to support the project with money. Even school children sometimes contribute their nickels, dimes and pennies. All of this makes a true community project and one of which the citizens can justifiably be proud.

Across the Delaware River from Phillipsburg, N.J., where this magazine is produced, lies Easton, Pa., an old city rich in tradition and historical background. In Easton is annually erected what is said to be the world's largest Christmas candle. It is dedicated to men and women from the area who have served or are serving in the armed forces. The 85-foot-high simulated taper is constructed around a monument that was built in 1899 on a small square park in the center of the city to honor Northampton County's Civil War heroes. In this area, known as Centre Square, Indian peace councils were held between 1756 and 1761, during which time the English endeavored to persuade the



## CLOTHING A MONUMENT

Easton's candle annually sheathes a Civil War monument that rises in the center of the square. The worm's-eye view above shows workmen placing the base section of the Yule taper. Overhead can be seen the boom of a 95-foot crane loaned by a local contractor. The figure at the upper left, seemingly peering skyward through binoculars, represents a Union sailor and is one of four lesser statues around the base of the monument.

Delawares and tribes of the Six Nations to turn against the French who were then threatening England's American colonies. Here too is the site of the county's first courthouse, built in 1705. Court sessions were held in the building from 1766 until 1861—a year before it was razed.

The Civil War monument, a tapered shaft mounted on a stepped base and topped by a statue of a Union Army bugler with a horn raised to his lips, is more than 70 feet high. On the base are four additional statues of Union men: a sailor looking eastward through binoculars to the confluence of the Lehigh and Delaware rivers; a cannoneer, the tools of his profession in hand, facing north; a rifleman on the west side representing the infantry; and gazing grimly into the south, a cavalryman, a drawn saber in his grasp. During the Yule season, the bugler is covered by the largest flame of the display and each of the lower figures is hidden by a smaller candle. At the foot of each of the lesser candles great silver bells are mounted and around the monument's base are placed about 700 Christmas trees brightly lighted with more than 2000 varicolored lamps. The orange "flames" are lighted from within and external spotlights focus on all sides

of the display. Thus a stark war monument is converted into a display that seems to hold forth the promise of peace on earth, good will to men. The Easton Area Christmas Committee has announced that a creche will be included in the Centre Square display this year. At selected hours the manger scene will be complete with live animals as well as actors representing participants at the Birth of Christ.

Volunteer labor puts up and takes down the exhibit each year. Two area contractors make the necessary equipment available: trucks loaned by Theodore C. Bean, Inc., bring the candle to Centre Square in 18-foot-long sections and a crane with a 95-foot boom is provided by Collins & Maxwell, Inc., to unload and hoist them into place. When first erected in 1951, the taper was 75 feet high. Several years later the "flame" literally burned and in the following

year was rebuilt and heightened. The original project was financed by public subscription and today, money for its maintenance and periodic repainting is still obtained in this manner. The annual dedication and lighting of the candle is an interfaith ceremony widely attended by area residents.

Often called America's Christmas City, Bethlehem, Pa., lies 11 miles west of Easton. This prosperous industrial community was born on Christmas Eve, 1741, when a small band of Moravian settlers gathered to worship in a crude log cabin on the banks of Monocacy Creek near its confluence with the Lehigh River. Singing an old Moravian hymn, "Not Jerusalem, Lowly Bethlehem!" they were inspired to name their little town after the birthplace of Christ. Christmas observances in Bethlehem today are resplendent with tradition. Vigils—ancient musical services of the



#### THE CANDLE BY DAY

The candle completely encloses the monument proper and brightly lighted evergreens and Christmas ornaments are heaped on the base to add to the Yuletide show.



#### RIGGING FOR CANDLE ERECTION

To the right of the monument, near the base of the flagpole, workmen are assembling one of the sections of the candle preparatory to placing it around the shaft of stone. When the candle is fully erected, its simulated flame is about ten feet above the head of the figure of a Union bugler that surmounts the obelisk.

Moravian faith—are kept each Christmas Eve in Old Moravian Church which is beautifully and elaborately decorated for the occasion. "Not Jerusalem, Lowly Bethlehem!" always is one of the hymns sung, thus commemorating the christening of the city. As the service concludes, "Sacristans"—volunteer layworkers—distribute lighted tapers to each worshiper and the congregation joins the choir in candlelight singing.

Adding to the festivity of the Yule season are elaborate decorations suspended along 41 city blocks and over two bridges, about 7 miles of lights in all. Some 28,000 lamps, 240 high-voltage fluorescent stars and bells and a great number of trees are placed for the annual display. The total electrical load is more than 325,000 watts.

Focal point of the city's decoration is located on what is known as the Hill-to-Hill Bridge that spans the Lehigh River and connects the city proper with the Borough of Fountain Hill. About halfway across the span, a spur branches off and angles down along the river. At that point there is a wide section serving as a traffic circle and known as Bridge Plaza. In the middle of the plaza is placed a tree which in recent years, has averaged about 52 feet in height. Made up of hundreds of small trees wired and otherwise fastened together the giant is decorated with 1200 varicolored lamps. One hundred fifty trees, all about 12 feet



#### BETHLEHEM'S BEAUTIFUL BRIDGE

The Hill-to-Hill Bridge that connects Bethlehem's business district with the Borough of Fountain Hill is splashed and festooned with lights and decked with evergreens. In the center is a giant tree, the composite of many lesser ones, decorated with 1200 lamps. Lining each rail are 150 evergreen trees uniformly 12 feet high. Above them lights are strung between the permanent standards on the bridge. Suspended in the air above the main approach is one of 240 fluorescent stars that are hung along some seven miles of Bethlehem's streets. The electrical load imposed by the Christmas lights is about 320,000 watts.



#### STAR OF BETHLEHEM

Daylight view of the star that shines down on the steel-making city of Bethlehem that takes its name from the Holy Land and goes all out in dressing up for Christmas. Measured to the extremities of the rays, the display is 81 feet high, 53 feet wide and is illuminated by 280 fifty-watt lamps. At Easter a cross is displayed by lighting only vertical and horizontal lines of lamps.

high, line the bridge and all are beautifully decorated.

It is claimed that Bethlehem has more decorations than any other city of its size in the world; that fluorescent displays were first used there; and that it was the first municipality ever permanently to install electric feeder lines for its Christmas lighting. The community project took form in 1937 and was financed by public subscription. Today preparations are started late in October so that everything will be in readiness soon after Thanksgiving day.

Most beautiful of all, however, is the Star of Bethlehem. Located outside and high above the city, this 81-foot-high and 53-foot-wide blazing emblem, finished in porcelain enamel, is permanently mounted on a 91-foot steel tower that has a base width of 25 feet. In reality, two stars shine down: one faces north toward the city and the other south. The unit can be easily converted to represent a cross by dimming some of its 280 large, clear, 50-watt lamps. As such, it is lighted during the Easter season. The star was built in 1937 as a part of the city's initial display program and with

the exception of a year or two during World War II was shown brightly each Christmas since. It is visible at Wind Gap, Pa., 15 miles north and at Coopersburg, Pa., 10 miles south of Bethlehem.

The emblem is located on top of South Mountain, which rises about 600 feet above the main business district of Bethlehem. The tower is anchored in concrete and is surrounded by a high fence, both for its own protection and that of curious children.

The Star of Bethlehem has a meaning of its own to residents in the area. Although they exclaim about the beauty of the town's other decorations and travel miles to see them, they regard the star as something more than mere decoration. There are those who firmly believe that on Christmas Eve, after the carolers have gone home, the children have been tucked snugly in bed, and after midnight religious services have finished, shadowy figures emerge on the slopes of South Mountain, seemingly following the blazing star. These same believers also know that a careful listener can hear golden angelic voices singing of hope, peace and good will to all mankind.

## Salt That is 'Saltier'

**A**S EARLY as 1833 it was discovered that lack of iodine in the human system often resulted in goiter. After considering various ways of giving people the minute quantity needed to combat the malady, someone suggested adding it to salt, and that has been done ever since. Now goiter is rare in America.

Iodine, however, is only one of many elements that may be lacking in man's diet. At least some of the missing ones seem to be beneficial to general health. Presumably, food raised in soil containing these substances is fortified with them, but actually few soils have all of them. Sea water, however, contains a trace or more of practically all the elements, including gold, and they are available today in a salt derived from ocean water. It is prepared by a firm in Houston, Tex., and sold under the name of Admiral Trace Element Sea Salt.

Until a few generations ago, domestic salt was obtained from long-dried-up ocean beds or areas along existing seashores and was sold pretty much as it was found. It was lumpy, moist and discolored, so man began refining it. He extracted the moisture-attracting magnesium and calcium as well as the discoloring elements such as iron and ended up with 99.8 percent pure sodium chloride. In contrast, sea salt available today runs about 75 percent sodium chloride and 25 percent other salts. Actually, 70 percent of the world's population still consumes unrefined sea salt, according to Dr. Arnold E. Schaefer of the National Institute of Health at Bethesda, Md., who has shown that cancer can be produced in rats, dogs and chickens through dietary deficiencies alone. Refined salt is used only in the United States, Australia and some parts of Europe. Whether coincidental or not, medical investigations reveal a striking reduction in the incidence of certain ailments among peoples that stick to straight sea salt for all its rusty appearance and lumpiness.

In the past it was thought that only eleven elements were necessary for animal growth; calcium, phosphorus, potassium, iron, magnesium, copper, manganese, sodium, chlorine, cobalt and zinc. The first hint that others were required came around the turn of the century following the discovery that animals would not thrive when fed imitation or synthetic foodstuffs. In seeking the cause, it was found that the foods were deficient in vitamins. It was then decided to conduct experiments during which animals were deprived of some of the trace elements and the effects noted.

Thus it was learned that lack of iron causes anemia; a deficiency in copper slows the manufacture of red blood cells, affects the hair of various animals and takes the kinkiness out of sheep's wool;

insufficient zinc retards the growth of rats and causes loss of hair; and lack of cobalt, manganese, fluorine and iodine have their own deleterious effects. At Rutgers University, twelve pigs fed a standard pig diet with sea salt in it gained 0.31 pound more each day than twelve others that received the same food with refined salt added.

More recently, tests at Texas A & M College and Cornell University showed that chickens and turkeys were materially benefited by including minerals in their diets. In 1950 the growth of chicks was increased 25 percent at the Texas school by adding either dry whey or condensed fish solubles to a so-called standard diet that had previously been considered adequate. It was assumed that organic substances were responsible for these gains, and efforts were made without success to isolate them.

No one thought of looking for inorganic substances such as minerals. Then a graduate student, who was not familiar with the field of nutrition, burned some of the additive and found that there remained an appreciable quantity of ash representing noncombustible inorganic components. The identity of the minerals was determined by means of the spectograph, and when a synthetic mixture containing them was fed to the chickens and turkeys their rate of growth was increased by as much as 77 percent. Additional research proved that the poultry was benefited by 23 or more mineral compounds instead of the eleven previously accepted as sufficient.

When the study was widened to include human beings, it was noted that tooth decay is only about one-fourth to one-third as prevalent in India as in the United States. (It is now generally accepted that fluorine curbs decay.) Teeth extracted in a dental clinic in Delhi showed a fluoride content far greater than that in typical American teeth. However, the water in India contains no more fluorine than that in Boston, for in-



stance, and it has been established that the Indians get their decay-preventing fluorine from the unrefined sea salt they use. Similarly, Eskimos rarely have dental caries, and that is attributed to their custom of drinking water obtained by melting sea ice.

In Asiatic regions, where sea salt is added to foods during cooking, the vitamin content is above normal and sea-salt users are unusually free from tooth decay, goiter anemia and rickets although often found to be suffering from malnutrition. One theory is that some of the trace elements in sea salt act as catalysts to enable the body to extract nutrition from food more effectively.

Sea salt is now being used in the Los Angeles Children's Hospital and is served in the Doctors' Club in Houston. Aside from its possible superior nutritional value, it is considered by many persons to make food tastier. It is reported that French chefs have long favored it for this reason and that even today many of the better French restaurants grind lumps of old-type sea salt in mills similar to pepper mills.

The Trace Elements Corporation, which is promoting sea salt in this country, extracts it in a plant located 35 miles south of Corpus Christi on the Gulf Coast. There clean sea water is pumped into a natural basin called Baffin Bay, where evaporation from the sun's heat increases the salt concentration to about double the original figure. Water is transferred from the bay to two settling basins where sand and insolubles sink to the bottom. It is then filtered, chemically treated and shifted to a reservoir where a submerged combustion evaporator reduces it to about 50-percent solids. Evaporation is completed in a rotary drier.

The salt is being sold through grocers, department stores and specialty shops in the larger population centers but is not available everywhere. It is also packed in 100-pound drums for pharmaceutical manufacturers and processors of stock feeds and fertilizers. Trace Elements Corporation reports that it is working on a trace-element concentrate in which the elements will be in the same proportion as they are in sea water, except that essentially all the sodium chloride will be removed. It is to be used to fortify refined table salt.

### Trace Element Sea Salt Contains:

ELEMENT	PERCENTAGE
Chlorine.....	50.5
Sodium.....	27.5
Magnesium.....	3.4
Calcium.....	0.86
Sulphur.....	1.83
Potassium.....	1.13
PARTS PER MILLION	
Iron.....	100
Fluorine.....	33
Copper.....	20
Molybdenum.....	0.013
Phosphorus.....	0.3
Iodine.....	1.5
Manganese.....	0.03-0.3
Zinc.....	0.15
Cobalt.....	0.1-1.0
and traces of many other minerals and elements.	

## This and That

### **Birthday for Notable Bridge**

George Washington Bridge, the only one that spans the Hudson River at New York, was 25 years old a few weeks ago. During its first year of service 5,500,000 vehicles crossed it; last year the count was 35,775,000 and it was the most used of the six vehicular facilities between New York and New Jersey operated by the Port of New York Authority. Traffic on the bridge will reach the capacity rating of 56 million vehicles a year in less than a decade, it is figured. Plans are already being made to add a 6-lane lower deck, which would increase the capacity by 75 percent.

Exceeded in length by only one suspension span, the Golden Gate Bridge at San Francisco, George Washington Bridge extends 4760 feet between anchorages and 3500 feet of it is over the Hudson, which it clears at mid-span by 248 feet. Approximately 105,000 miles of wire makes up the four main suspension cables, which are strung over two 600-foot towers containing 43,000 tons of steel.

More than a century of discussion preceded the construction. A wooden structure was proposed in 1811, before the problem of providing clearance for boats existed and ideas were modified through the years as conditions changed. In 1868 New Jersey passed legislation authorizing construction of a railroad

bridge and New York enacted similar legislation 22 years later, but nothing resulted. In 1887 the Pennsylvania Railroad proposed erecting a suspension bridge but that scheme, like earlier ones, failed to materialize because of the cost and intricate engineering problems involved.

Finally, in 1923, after the formation of the Port of New York Authority, a new proposal appeared and was acted upon. Construction started in 1925 and was completed in 1931, eight months ahead of schedule. With its approaches, the bridge has cost \$76,300,000 to date and improvements are still being made from time to time. An operating staff of 250 is employed, aside from 50 painters, who just finished the 2-year, \$350,000 job of applying a coat of aluminum paint—the fourth the structure has received. Newly installed mercury-vapor lamps provide four times as much illumination as the incandescent type previously used.

The bridge was designed by Othmar H. Amman, a native of Switzerland, who also directed its construction. Provisions were made for the addition of a second deck. Only minor changes to the structure will be required to do this, but extensive work will be needed to expand the approaches and the cost of the entire improvement has been estimated at \$82 million, of which \$20 million would be for the bridge structure.

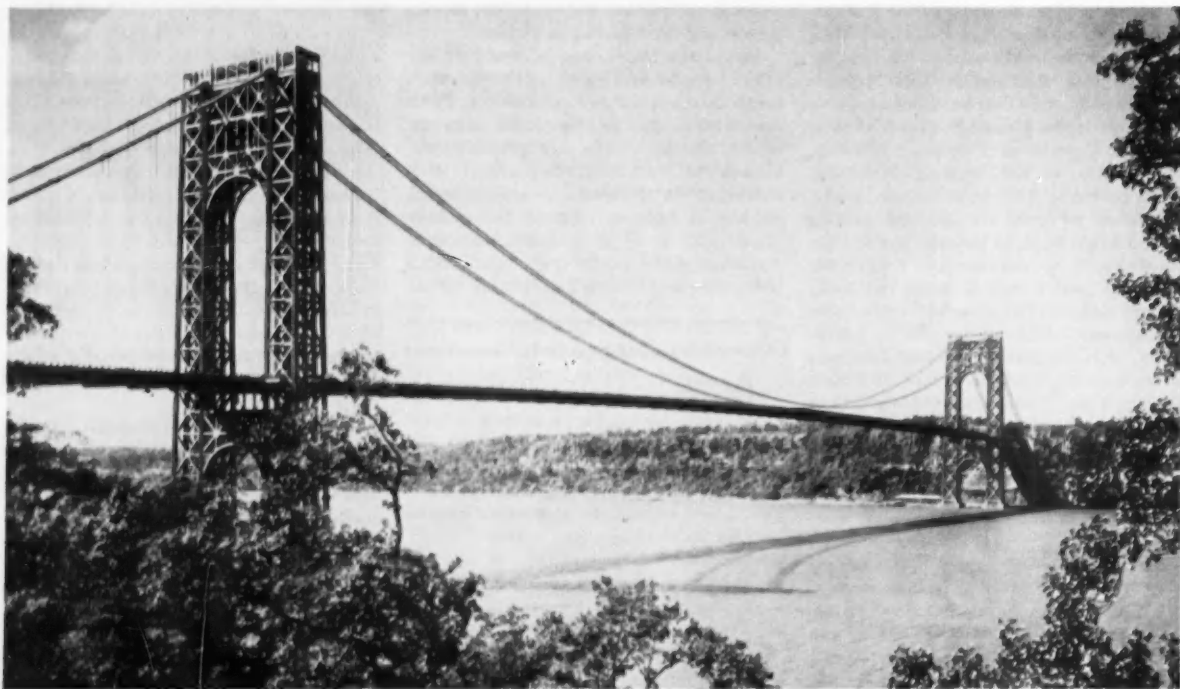
### **Gems That Write**

Pen points made of synthetic sapphire are now being used on strip-chart recording instruments made by Minneapolis-Honeywell Regulator Company. The gems are about the size of a pinhead and are rounded to prevent scuffing of the paper. For such service synthetic gems are better than real ones because they can be made perfect whereas a natural gem derives some of its value from flaws. The jewel-tipped pens not only have an unlimited service life expectancy but are reported to be scratch-free and to produce a more uniform line than metallic nibs.

★ ★ ★

### **Huge Road Cut**

What will reportedly be the largest single highway cut in the United States is being carved in the landscape at Selby, Calif., near San Francisco. It will be 3000 feet long, 1370 feet wide at the top and up to 350 feet deep. If a 25-story building were set down in it, the roof would be about even with the top of the cut's highest side. Called the largest individual excavation since the Panama Canal's famous Culebra Cut was formed, the California gash is to be part of the San Francisco-San Raphael Freeway that has been under construction for 8 years. Much of the excavated material will go into a 140-foot fill.



GEORGE WASHINGTON BRIDGE WITH NEW JERSEY SHORE IN BACKGROUND

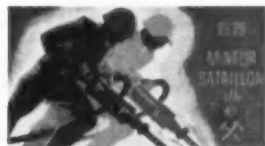
One of the most placid sights in our entire countryside is a field of corn waving gently to and fro in a light summer breeze.

Yet here in the making is material that can blow you sky high, for products derived from corn are important ingredients of high explosives, particularly dynamite. In 1953, for example, nearly ten million pounds of corn starch was sold to dynamite manufacturers.

Few industrial products rank higher on the scale of essentiality than dynamite. Without it hardly a road could be built; a great many mining projects could never be started; and farmers would lack one of their essential ground-clearing tools. Thousands of tons of the explosive is required annually for these purposes.

When Alfred Nobel invented dynamite about a century ago he used a mixture of nitroglycerin and kieselguhr, a porous diatomaceous mineral. Later, more powerful dynamites were developed by replacing the inert kieselguhr with a carbonaceous material, which serves as a fuel and adds to the strength of the mixture, and an oxidizer such as sodium nitrate or ammonium nitrate. Still later, "gelatin" dynamite was made by mixing nitrocotton (guncotton) with the nitroglycerin.

A variety of carbonaceous substances enters into different kinds of dynamite. The Atlas Powder Company, for example, uses corn starch, corn meal, ground corncobs, wood pulp, bagasse, and fine sawdust, as well as such less common materials as ground apricot pits and walnut and pecan shells. These and others are needed to produce the great variety of characteristics built into modern dynamites to make them more useful for their specific purposes. Such prop-



#### SWISS POSTAGE STAMP

A few stamps showing some type of air-operated tool have been printed by European nations. This one, brought out in 1939, is said to be the only one ever to feature paving breakers.

erties as density, resistance to moisture (a highly desirable characteristic where the dynamite is to serve in damp places), velocity of detonation and others are controlled largely by varying the kinds and proportions of carbonaceous materials used.

Corn starch is one of the most useful of the carbonaceous materials selected for the formulation of both dynamites and gelatin dynamites. The latter, like the others, are packed in the familiar fiber (paper) tubes or shells which explosives people call "cartridges." But in the case of the gelatin types packing is done by means of a "jelly stuffer," a device that extrudes the mass into the shells.

Sometimes corn starch is utilized in making the primary explosive agent—it can be nitrated to produce an explosive nitrate ester the same as glycerin and cotton. At least one company is reported to be using nitrated starch as the main explosive ingredient in its dynamite. Other products that can be nitrated to provide high-explosive compounds are mannitol and sorbitol. These substances are made by chemical conversion from dextrose (corn sugar), the latter being obtained by converting corn starch. Nitrated mannitol is the primary explosive element in some kinds of detonators that are required to set off explosive charges, and it is also used in explosive-type rivets. Sorbitol nitrate enters into dynamites.

This is just one of the many lesser-known applications research has found for corn products. Laboratory work done individually by corn refiners and in such jointly sponsored programs as that of the Corn Industries Research Foundation have been of vital importance in increasing the usefulness of our greatest agricultural crop.

★ ★ ★

#### New Job for Barbers

Researchers at Bell Telephone Laboratories 8 years ago discovered a strange phenomenon that explains why radios, for example, as well as other electronic gadgets sometimes, and seemingly perversely, go "on the blink," yet when moved to a repair shop perform perfectly. It's because

whiskers grow on tin, zinc and cadmium! Electrical components made of these metals sprout spine-like projections that push through insulation and can cause short circuits. Movement of the equipment sometimes causes the whiskers to break, thus clearing the trouble. Nobody knows why they form, but Bell Labs reports that their average diameter is about 0.0001 inch, that they grow about  $\frac{3}{8}$  inch per year and that some even are hollow. Heat and humidity speed up their crystalization, it is said, and it has been learned that the whiskers are composed of 100-percent pure metal. Furthermore they develop from the base up, new crystals forming at the root and pushing up those deposited previously.

★ ★ ★

#### Balloons Can Fly Longer

Engineers at the Air Force Research Center in Cambridge, Mass., have found a way to replenish hydrogen gas lost from a high-altitude weather balloon while it is still in flight. A container that holds nearly 120 gallons of liquid hydrogen can be attached to the balloon for automatic refueling. The device will enable balloons to remain aloft many hours longer than previously and thus to make more extensive observations.



#### ANCIENT HAMMER WIELDER

Gravestone in Hofgastein, Austria, of goldsmith Christoph Weitmoser, 1558. Of red Salzburg marble, it shows a miner wielding a hammer with a flexible handle. Hofgastein, a well-known spa, was once famous for rich gold and silver mines which were worked from the time of the Romans until the seventeenth century. The illustration is reproduced from an article on "Stone in Art" in "Zeitschrift fuer Erzbergbau und Metallhuettenwesen."



"The last place I worked for gave me more in benefits than you do in salary. I'd still be getting them if the place hadn't folded."

## Atkinson and Perini to Get Moles' Awards

GUY F. Atkinson and Louis R. Perini, who hail from opposite sides of the continent, will receive the 1957 awards for "outstanding achievement in construction" that are given annually by The Moles, New York organization of tunnel and heavy construction men. Atkinson, who lives in San Francisco, will get the traditional nonmember citation. Perini, a resident of Framingham, Mass., has been a member of The Moles since 1948. The awards will be presented next February 7 in New York City.

Atkinson is board chairman of Guy F. Atkinson Company, which has built scores of major structures in this country and abroad, including Grand Coulee Dam, Treasure Island for the San Francisco World's Fair, McNary Dam and powerhouse and the Hanford, Wash., atomic energy plant. He has been engaged in construction work for 65 years.

Although he was born in Pennsylvania, Atkinson was taken west by his parents when young. Leaving high school at the age of 16, he attended business college for 6 months and then became a timekeeper and bookkeeper for his father's contracting firm. When he reached 21 he was made a partner and helped erect buildings in Nebraska, Iowa, Utah, Colorado and Wyoming.

In 1902 he joined a brother, Walter, in a partnership. They opened an oil field in Oklahoma, built and ran a hotel in Colorado Springs, Colo., and did general construction work. Their largest job was the building of Fort Warren in Wyoming under a \$1,500,000 contract. In 1910 they moved to Los Angeles, formed the Southwestern Construction Company and erected buildings until 1914, when they entered the highway construction field.

In 1918 Guy moved to Portland, Ore., and began building roads on his own. In

1925, with a nephew, Lynn Atkinson, he constructed Pardee Dam. In 1929 he incorporated the present Guy F. Atkinson Company and his son, George H., became an associate. Since then the firm, either alone or with other contractors, has participated in more than 100 large construction projects. It is currently working on the \$60-million Dalles Dam in Washington, the \$60-million Sakuma Dam in Japan, the \$30-million Ambuklao Dam in the Philippine Islands and twenty other sizable jobs.

Although he had little formal education, Atkinson was given an honorary degree of Doctor of Engineering by Willamette University, of Salem, Ore. In 1939 he served as president of the Associated General Contractors of America and has long been active in its affairs.

Louis Perini's father was also a construction man, a man who came here from Italy in 1885 and worked with his hands to get the money with which to start contracting in 1900. Thereafter, he built all or sections of highways, dams, roads, bridges and other structures in the Boston area. In 1917 the present firm of Perini & Sons, Inc., was formed. The sons were Fred, then 25 and now retired; Joseph, then 18 and now treasurer; Louis, then 15 and now president; and Charles, then too young to work. Each in turn, as he grew up, took his place in the business, starting at the bottom. Louis became president of the company when he was 21.

The father died in 1924, soon after the concern had submitted a low bid of \$350,000 on a road job near Lakeville, Mass., the second largest piece of work it had tackled up to then. The boys were able to convince the officials of Massachusetts and a bonding company that they could carry out the contract and it was awarded to them.

During the 1920's the firm handled many road paving jobs in New England and did flood rehabilitation work in Vermont. In 1930, on the Boston-Worcester Turnpike, the Perinis used their first bulldozer. On that project also the firm attracted attention by laying 5531 lineal feet of concrete pavement (1540 cubic yards) in one 11¼-hour working day. This was made possible by employing transit concrete mixers and a concrete spreader, both innovations at the time.

In the 1930's the company deepened and widened Cape Cod Canal for the Government and pioneered in the use of Euclid bottom-dump trucks for moving the large quantities of earth involved. While doing war work during the second world conflict, the Perinis became interested in coal stripping in West Virginia and produced and marketed as much as a million tons of the fuel annually. One of the firm's big wartime jobs was the construction of Logan International Air-

port in Boston, which was virtually taken from the sea. Two islands were leveled to provide 3,500,000 cubic yards of earth and 40 million cubic yards of fill was dredged from the water.

Among major undertakings to the firm's credit are the \$10-million Hultman Aqueduct for Boston's water supply, the \$25-million Jim Woodruff Dam, the \$20-million Squirrel Hill Tunnel in Pittsburgh, the \$36-million Barnhart Island Power Plant and the \$26-million Grass River Lock on the St. Lawrence River. Two Canadian affiliates, both headed by Louis Perini, have driven the tunnels for the \$55-million Sir Adam Beck power project at Niagara Falls, constructed two tunnels and a concrete dam for the \$30-million Bersimis power development, excavated tunnels and space for an underground powerhouse for Aluminum Company of Canada, Ltd., and built Canada's largest uranium ore concentrator for Consolidated Denison Mines.

Some of the larger undertakings in which the American concern has been or is a joint venturer with other contractors are Chief Joseph Dam powerhouse, the Fairless Works of United States Steel Corporation at Morrisville, Pa.; a \$42-million Delaware Aqueduct tunnel for New York City and the \$64-million Snowy Mountains hydroelectric project in Australia.

Louis Perini is known to millions of American baseball fans as head of the group that owns the Milwaukee Braves club in the National League. From the time he was a catcher on a boys' team at the age of 10, Louis has been interested in the sport and in 1943 he and two other Boston contractors bought the Braves, then located in Boston. Patronage in Boston fell off and in 1952 the franchise was transferred to Milwaukee. The team finished second in 1956.

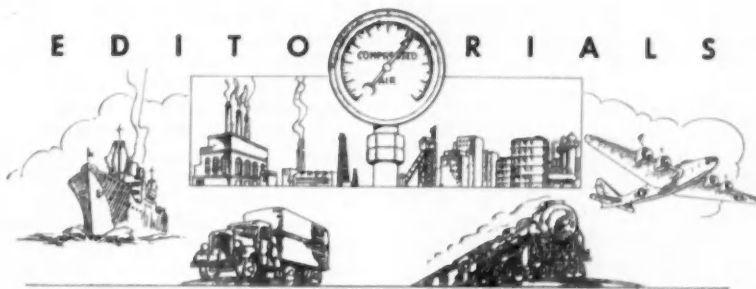


GUY F. ATKINSON



LOUIS R. PERINI

## EDITORIALS



### TOYS ARE BIG BUSINESS

**F**IGURATIVELY speaking, this is the season when the toy industry "makes hay while the sun shines." Sixty percent of toy retail sales are made in November and December. For many years toy production has practically ceased in October and hasn't been resumed for several months. Large retail chain organizations do their buying for Christmas in the preceding January and the toy factories then begin to hum. They get another boost in March when the annual toy fair is held, but that about winds up the buying season.

The toy industry is trying to change this operating program—to distribute sales and hence manufacturing throughout the year. And it is making some progress. Hardware and automobile accessory stores, which formerly sold toys only at the year-end, are now displaying them at other times. Supermarkets and children's clothing stores are beginning to stock toys for the first time and will, presumably, push them throughout the year. Certain articles, such as bicycles, already sell well during the months when they can be used most.

The boom in babies since World War II has been a tonic for the toy business. Between 1940 and 1950 the number of children in the nation increased from 21 million to 30 million. Continually growing pay checks have also stimulated toy buying. Last year's sales topped one billion dollars and an additional gain of between five and twenty percent is expected this year. Fatter pocketbooks have also influenced the type of toys offered on Christmas counters. One manufacturer is after the de luxe trade with a Teddy Bear that retails for \$300 and is also displaying a toy automobile at \$15 that has a transparent hood for easy viewing of the working mechanism.

With toy-making already big business and expanding rapidly, it looms as a fertile field for suppliers of raw materials, machines and tools. Metal toys account for about 30 cents out of every dollar of sales and the industry will consume around 228,000 tons of metal in 1956—most of it in the form of steel strip and sheets. The percentage of metal per toy goes up as the price of the toy increases and ranges up to 68 percent in those that retail for more than \$10.

Some large metalworking companies are getting into the toy business as a means of diversifying their operations. American Machine & Foundry Company and Revere Copper & Brass, Inc., are two.

Toy makers report that the buying pattern of the public is changing. Despite television, games are selling better than they used to. There is also a trend towards realistic toys. One firm that once emphasized toy soldiers is now doing well with a chemistry set that enables youngsters to carry out an atomic energy experiment. The company has also been successful with a microscope kit for science-minded children. Among the accessories are shrimp eggs that can be followed through the hatching and early growing stages. Industry leaders freely admit, however, that nothing would boost business like another Davy Crockett craze.

### STRUTTING THEIR STUFF

**A**S A GROUP, construction men are a proud lot. They do good work and they are not ashamed to put it under the spotlight. In 1900, a tidal wave engulfed Galveston, Texas, and left 6000 dead. To guard against a recurrence, a sea wall was constructed. Fifteen years after the first storm another one hit the community and took 275 lives. First reports were that the sea wall had gone out. The contractor who had erected it, a Denver man, was interviewed. Without hesitation, he offered to wager \$1000 that the reports were false. "I know how the wall was built," he said, "and I am sure it didn't fail." He was right; the structure was topped but not breached.

Contractors are not only proud but also perhaps a little vain. They are pleased when people notice what they are doing and even willing to spend money to make it a little easier for them to do so. Until about 25 years ago, curious strollers in big cities had to find knotholes in the fences enclosing building excavations in order to get a glimpse of the show. During the construction of Rockefeller Center in New York City in the early 1920's the George J. Atwell Company introduced the innovation of a windowed observation post for John Q. Public and the term "side-

walk superintendent" came into being.

Since then accommodations for these self-appointed experts have been continually improved. Plans, models, color transparencies, tape recordings and other visual and aural aids have been added in some instances to help the man in the street understand what he is seeing. The latest touch of refinement is a Christmas display at the site of a new building that is rising on Fifth Avenue between Fifty-second and Fifty-third streets in Manhattan Borough of New York City. A 15-foot-high Santa Claus sits on the fence holding and looking at a set of authentic plans for the structure. High above, clinging to the girders of the growing steelwork, are six man-sized pixies, each wearing a regulation hard hat.

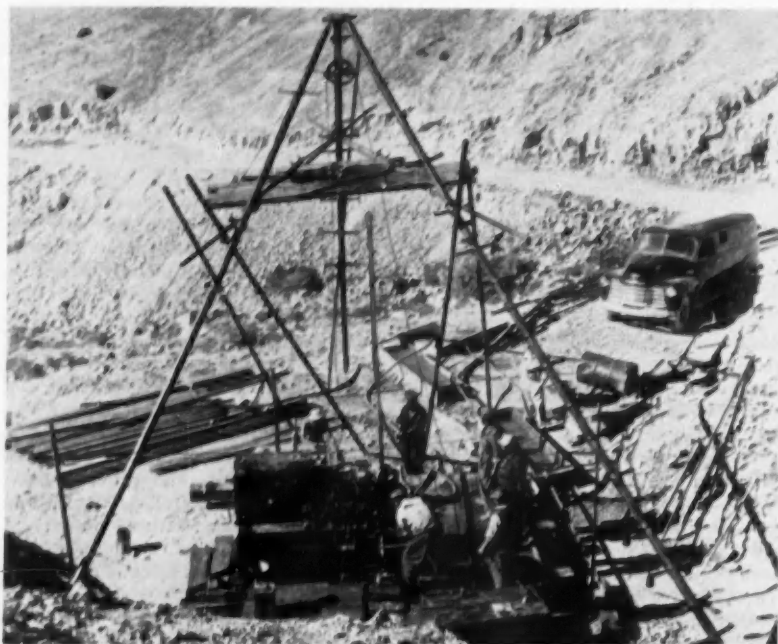
Heavy construction men have proved that hardheadedness and softheartedness are not incompatible. Lots of concerns pay well for public relations counsel and get less good will in return than contractors do by just being human.

### METALS OF THE FUTURE

**F**OR centuries man got along with a few metals. Iron, copper, zinc, tin and lead once sufficed for most of his workday activities, with gold and silver serving the needs of coinage and the arts. Most other metals then known were classed as rare, mainly because they were rarely used. In recent years some of them have been transferred from the rare to the common category. Only 35 years ago aluminum was a curiosity; today everyone is familiar with it. Magnesium and titanium are undergoing the same transition now. Most of us are acquainted to some extent with mercury, nickel, chromium and a few others.

At this year's American Mining Congress, Eugene B. Hotchkiss, vice-president of Vitro Corporation of America, gave a list of 65 metals that may still be considered as rare. Included are some that are abundant in the ground in combination with other elements but seldom used in metal form. Silicon, for example, makes up 28 percent of the earth's crust, but few persons have ever seen metallic silicon.

Yet, these are the elements that hold great promise for the future. Such words as tungsten, molybdenum, beryllium, zirconium and germanium are becoming known to the average man and are already very familiar to technical workers. Radium and uranium are commonplace terms by reason of special applications of these metals. Many of the others, such as lithium, selenium and thorium are being intensively investigated and the veil of obscurity is gradually being removed from them. Industries now unknown to us will someday be based on substances with such strange-sounding names as hafnium, indium, rhenium, tantalum, yttrium and a host of others.



#### DIAMOND DRILLING AT NEW MINE SITE

Coring rigs such as this one have proved the existence of perhaps 200 million tons of 1.6-percent copper ore in a deposit on Indio Muerto Mountain.

### New Copper Mine Being Opened in Chile

**A**NDES Copper Mining Company, subsidiary of Anaconda Company, plans to spend \$80 million in establishing facilities for mining and milling copper ore at its El Salvador Mine project in Chile. This represents an increase of \$27 million over the estimates made last March, when the Chilean Govern-

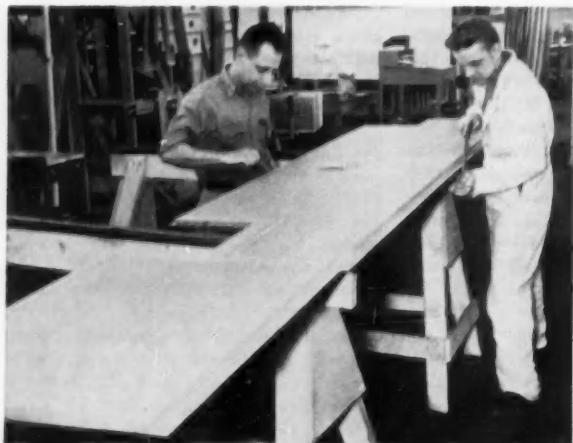
ment granted authority for investing \$52,950,000. Enlargement of the plans resulted from discovery of additional ore as a result of exploratory drilling and tunneling. The original estimate of 78 million tons averaging 1.6 percent in copper content has now been stepped up to 200 million tons of the same grade.

The mine will be located at Indio Muerto Mountain, 18 miles north of Potrerillos, where the company has been mining copper since 1927. The Potrerillos deposit will, however, be exhausted within four or five years, by which time the new one will be in full production. Indio Muerto is about 100 miles from the coast and rises 11,000 feet.

The revised plans call for developing an underground mine. A main haulage-way will be driven about 2½ miles into the mountain and electric-locomotive-drawn trains will haul ore out through it to the concentrator. Two adits will be driven on different levels to facilitate mining. The concentrate will be pumped, as a slurry, 15 miles through a 5-inch pipeline to Pastos Cerrados, on the railroad. After being filtered there, it will be shipped by rail to the smelter at Potrerillos. Copper produced there will be hauled by railroad to Barquito for loading into ships. The annual output is expected to be about 100,000 tons.

About 2 miles from the mine, in a sheltered location at an altitude of 7000 feet, a modern village to house the workers will be built. To be called El Salvador, it will include, besides up-to-date dwellings, a theater, an employees' club, schools, hospital, church, stores and various playgrounds and athletic fields.

Evidence exists that mining was carried on at Indio Muerto Mountain centuries ago. There is a quarry-like pit 50 feet deep from which Indians who came after the Incas are believed to have mined turquoise. Hammers of stone tied to handles with leather thongs have been found there and from the site an ancient road can be discerned taking off over the mountains towards Bolivia.



#### MARTIN SAVES WITH AIR POWER

At the Martin Company, in Baltimore, Md., long aluminum wing panels and trailing edges of airplanes were formerly scribed and cut to size. The edge then had to be manually filed to the scribe line—a time-consuming and costly operation. They are now trimmed with the improved equipment shown at the right. Double-acting pneumatic cylinders at either end of the fixture clamp an aluminum beam across the piece to be trimmed, holding it securely.

The air pressure is applied and released by actuating a pedal-operated valve. A router that moves along the front of the fixture is then used to do the trimming, creating an even, smooth edge. The picture shows a Stanley electric-powered router; however, a Quackenbush air-powered machine can be and is frequently used. The new method has reduced trimming time per unit by 60 percent.

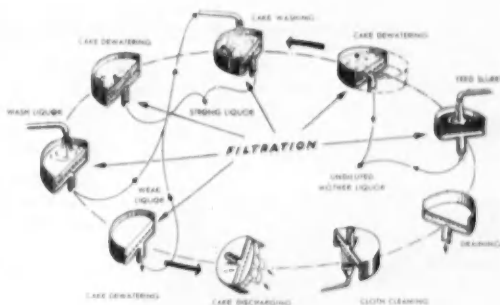
## Merry-Go-Round Vacuum Filters

AFTER several years of successful operation in Europe, especially in phosphoric-acid plants, the Bird-Prayon vacuum filter has been introduced in the United States by the Bird Machine Company. Of the horizontal type, it operates in a continuous, automatic cycle and is said to be highly effective for processing coarse or heavy materials, metallic concentrates or solids that normally "blind" filter cloths and for service where cake wash is of importance. The unit consists essentially of a circular frame rotated by a rack and supporting a series of tilting cells or pans that are spotted successively under a feed distributor and several washes and are then tipped 180 degrees to unload the cake.

Each cycle, the filter permits counter-current washing at as many as five stages during which the wash liquors are kept separate from one another and the mother liquor; gravity removal of solids aided

by blower air; cleaning and drying the cloths by a pressure shower and blast of air; and drainage of all wash liquor before new feed is introduced. Virtually any kind of filter cloth may be used and can be changed by detaching a few clamps, lifting the wire from a cell and substituting a new cloth for the old one.

All parts of the equipment are accessible, and little supervision is required while filtering is in progress. Six sizes are available and range in frame diameter from a little less than 13 feet to 45½ feet and in filter area from 30 to 520 square feet. In removing gypsum from phosphoric acid, one of the large units is reported to be operating



### HOW THE FILTER WORKS

This schematic drawing shows the sequence of operations. The filtrate is distributed by flexible hose connections, and the pans are linked through hose and a central rotating valve to flexible vacuum lines. The filter may be constructed of stainless steel, monel, lead or aluminum and may be covered with rubber or plastic, whatever service requirements dictate.

with a washing efficiency of 99.5 percent without dilution of the mother liquor.

Circle 11 on reply card

## French Tidal-Power Project Underway

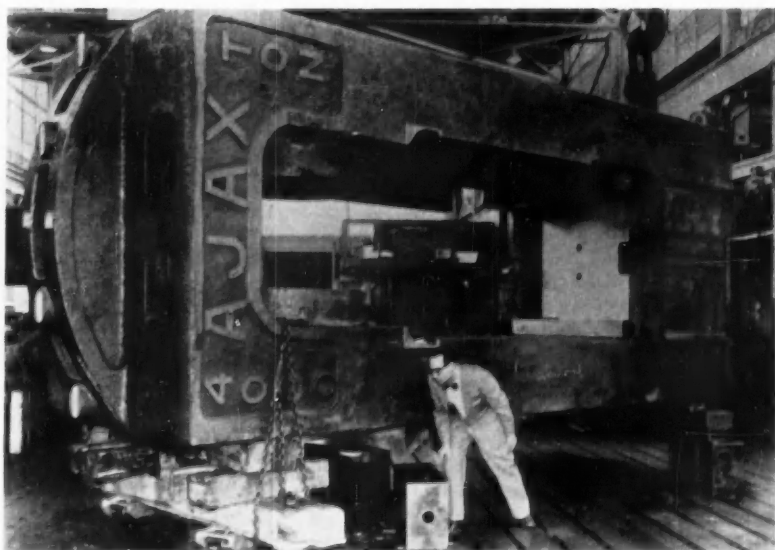
POWER plants to harness tidal waters have been discussed, planned and started off and on for years, but it has remained for the French through the development of a new type of turbogenerator to go ahead with a scheme that is designed to add 800 million kw-hrs to the country's supply of electric energy. The project is to be built at an outlay of around \$100 million on the Rance River at a point upstream from St. Malo on

the English Channel coast of Brittany where the tide reaches a maximum height of 37 feet.

The power plant on the estuary was actually on the drawing boards in 1951, but at that time was based on the conventional vertical-axis turbine that would have produced current only on the ebb tide. The idea might have gone the way of all the other tidal-power schemes but for the fact that a horizontal-axis

turbine, on which engineers had been working for many years, was brought to a practical stage of development in France. Of relatively small size, it is referred to either as a *monobloc*, because the turbine and the generator are in the same housing, or as a bulb unit because of the shape of the end containing the generator. The machine will produce power with the water flowing in either direction and, by serving as a pump, will raise or lower the level of the reservoir to be created by the construction of a dam and thus, at intervals between tides, increase the head on the turbines from 15-20 feet to 18-25 feet. Discounting the power consumed by the pumps on the Rance River Project, this feature of the turbine will add 100 million kw-hrs to the station's electric output.

The dam will be about 2300 feet long, 160 feet wide and 85 feet high from its footing in the estuary. It will double as a powerhouse. In line with the flow of water it will have 48 openings: 38 to accommodate the turbogenerators and five at each end with hydraulic lift gates to help fill and lower the reservoir level. On the left bank will be a navigation lock. Each of the 38 units to be installed will have a maximum diameter of 18 feet and weigh approximately half as much as the familiar vertical machine. With a combined rated capacity of 342,000 kw (9000 each), the station will, as already mentioned, have a net output of 800 million kw-hrs because of the additional power production made possible by the generating-pumping units. Work on the undertaking was begun in 1954 and is scheduled for completion in 1963. It is being carried out by the Electricite de France.

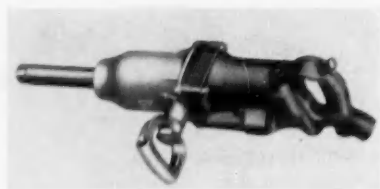


### LITTLE BUT MIGHTY

Shown here is a big moving job in the plant of the Ajax Manufacturing Company. The roller skids being used for the purpose are so small that they are barely visible beneath the timbers supporting the 150-ton frame of a forging press. They are of the Multiton extra heavy-duty type and transported the heavy load a distance of 150 feet in less than 25 minutes. The skids are made by Stokvis Edera & Company, Inc., of Port Washington, N. Y.

## Industrial Notes

To lessen the likelihood of road failures in truck and bus service, Ingersoll-Rand Company has introduced a new model in its line of air-powered Impacttools.



Known as the Size 334, it is designed especially for automotive maintenance work such as tire changing, tube inspection, spring repairs, etc., that requires the removal and replacement of heavy nuts and bolts. The tool has a 1-inch drive and, including the 6-inch extended driver, is 25 7/8 inches long. It operates with a free speed of 690 rpm and delivers 1330 impacts per minute. In addition to the regular grip handle, it is provided with a side spade handle that makes it easy for the mechanic to balance the tool and to work in any position without tiring and at increased speed.

Circle 2E on reply card

Skip drilling as a standard function of drill presses is possible, it is claimed, through the use of an automatic drill-feed attachment announced by General Pacific Corporation. The unit is air-powered and hydraulically controlled by means of three knobs that adjust all precision operations. At the touch of a foot valve the attachment goes through its full cycle: makes a fast approach and



drills at a set speed and depth to an accuracy within 0.002 inch, repeats both performances and then retracts to the starting position. So converted, a drill press can handle other production jobs

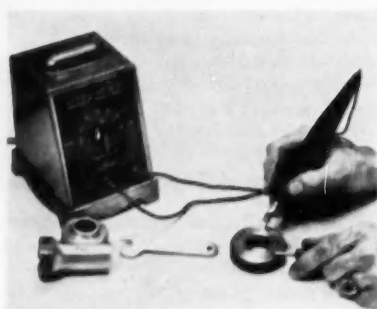
such as tapping, reaming, threading, counterboring, spinning, spot-facing, etc.

Circle 3E on reply card

Spaghetti tubing made from Du Pont Teflon is being marketed by Pennsylvania Fluorocarbon Company for electronic and electrical applications. It is sold in different colors for identification.

Circle 4E on reply card

For marking, engraving and etching either thick or thin lines permanently on metals from the hardest tempered steel to gold and silver, Newage International, Inc., has developed an electric vibrating



pen called the Actograph. It is small and light, safe and easy to handle and requires no special preparation before use. The point can be resharpened by a smooth file and has a long service life.

Circle 5E on reply card

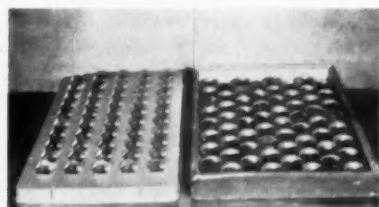
Large wire-mesh baskets filled with loose rocks and tied together are being used in Italy, Great Britain, Canada and elsewhere in the construction of groins, retaining walls and other protective river works. Introduced in Italy in 1890, where early installations are still in position, the containers are now available in the United States under the name of Gabions. They are made in varying sizes by Sea Gabions, Inc., and each has a cover that is wired shut to hold the material in place. They are said to form a flexible mat that remains intact under the movement of the bank, resettling to prevent further erosion.

Circle 6E on reply card

What is said to be the first slip-type pipe expansion joint of unplasticized polyvinyl chloride has been introduced by Tube Turns Plastics, Inc. The fitting is designed for use with rigid PVC piping subjected to thermal cycles and for a wide range of corrosive services. It has been tested at temperatures up to 140°F and a maximum pressure of 325 psi. Sizes of 1, 2 and 3 inches are available and permit 3 3/4 inches expansion.

Circle 7E on reply card

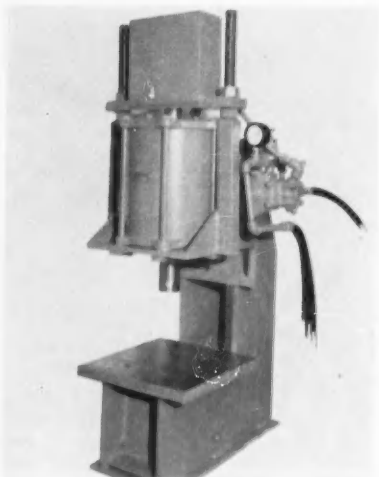
G. Felsenthal & Sons, Inc., has developed a lightweight plastic tote tray that is currently on trial in the clock-assembly plant of George W. Borg Cor-



poration. Unlike the heavy, bulky wooden trays with individual metal cups or holders, the new ones have compartments molded to cradle small parts. As a workpiece from one tray is added to that from another, the assembly is placed in still another tray shaped to accommodate it. Because of their reduced weight, plastic trays can be stacked high and easily carried without damaging the parts. Furthermore, they can be cleaned quickly with compressed air which blows all dust and harmful grit from the smooth surfaces in one operation, thus saving the time spent in removing the cups from the wooden trays and washing and drying everything separately. The new type tote tray can be molded to meet any industrial requirement.

Circle 8E on reply card

Announcement of a new line of Vi-Speed air arbor presses has been made by Van Products Company. There are sixteen models ranging in capacity from 1 to 5 tons with

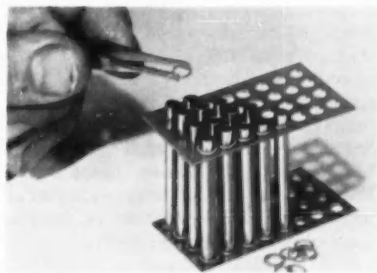


air at 100 psi. Units are available with a single cylinder, as shown, or with one above the other to keep the base dimensions of the machine down to a minimum and to increase the thrust. In the case of

the stacked cylinders only one is used on the return stroke to conserve air power. Most rams are keyed for nonrotation. Of rugged construction, the presses have a maximum throat clearance of 6 3/4 inches and an adjustable ram clearance of up to 12 inches. They are suitable for operations such as riveting, forming, bending, cutting, press-fitting, etc.

Circle 9E on reply card

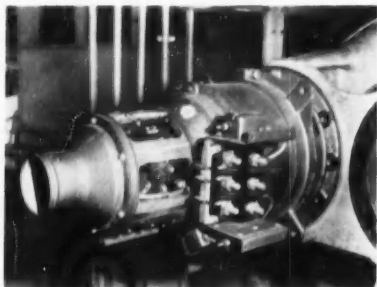
Numerous advantages are claimed for a new line of prefabricated Nicrobraz brazing rings for use with stainless-steel tubular assemblies of all kinds. Offered by Stainless Processing Division of Col-



monoy Corporation, the rings are said to be superior to older types in quality and finished appearance, to eliminate waste and greatly to reduce assembly time. They are made to specifications in alloy grades for all standard or special tube sizes, and dimensional tolerances are guaranteed within 0.001 inch.

Circle 10E on reply card

Announcement has been made by the A. K. Allen Company of a new single-solenoid valve-in-head pneumatic cylin-



#### HELPS INSPECTORS

Temporary replacement of a solid air-blast commutator cover with one made of plexiglas that is easy to install has greatly facilitated the work of testing aircraft generators at the plant of The Glenn L. Martin Company, Baltimore, Md. Exposure of the commutator by removing its housing diverted the cooling air flow and resulted in possible overheating of the generator and insufficient inspection. With the transparent cover developed by Martin (indicated by arrow), arcing between brushes and commutator can be observed under normal conditions and any trouble quickly detected.



der. The valve is of the air-return, 4-way type and has no springs in its construction. The solenoid is designed for 110 volts, 60 cycles continuous operation. Each time it is energized, the piston rod of the cylinder goes forward; breaking the electrical contact returns the rod to its original position. The new cylinder will function on air pressures of 5 to 150 psi, and the valve itself will cycle at 800 strokes per minute.

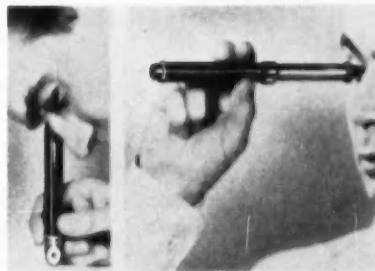
Circle 11E on reply card

Something revolutionary in hot-dip, galvanized quench tanks has been introduced by Waltz Furnace Company. Of the semimobile type, it rests on the floor and is a tank within a tank, the area between the two serving as an overflow section for water or oil, depending upon the quench. In either case the inner tank is filled to overflowing and the annular space to a point above cooling coils. The hot liquid is pumped from the

outer into the bottom of the inner tank and is forced over the top of the latter back into the cooling section. The work basket is mounted on a centrally disposed air cylinder and can be rotated and oscillated as it is moved up and down.

Circle 12E on reply card

For the convenience of operating engineers, laboratory technicians and design and research men, Edmund Scientific Corporation has developed a combination 50-power microscope and 10-power telescope of pocket size provided with a clip to hold it in place. Used as a microscope for examining small parts, spot-



ting, checking and inspecting, it is just tilted to focus and a metal reflector throws light on the specimen. When the instrument is to serve as a telescope, the reflector is unscrewed and the eyepiece

## NON-FLUID OIL

TRADE MARK REGISTERED

### "NR" GRADE PROVES ITSELF!

A case in point - a large user of pneumatic tools was ready to replace some equipment that he considered worn out. A N. Y. & N. J. Lubricant sales engineer suggested they merely lubricate the tools with NON-FLUID OIL "NR" grade.

Result: The tools are back on the job - running at better than their rated speeds.

NON-FLUID OIL "NR" grade, absorbs moisture, prevents rusting, raises tool speeds and eliminates the necessity for dip-tank storage. Try it yourself and see. Send for detailed Bulletin 550, and a free sample of "NR" grade.

### NEW YORK & NEW JERSEY LUBRICANT COMPANY

292 MADISON AVE., NEW YORK 17, N. Y.  
WORKS: NEWARK, N. J.



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Charlotte, N. C. Springfield, Mass. St. Louis, Mo.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 17A on reply card

tube and sight are drawn out, bringing distant objects such as gauges ten times closer.

Circle 13E on reply card

Trico-Mist is the name of a portable unit designed by Trico Fuse Mfg. Co. for the application of soluble wax or oil coolant to the cutting edges of drilling, tapping, milling, sawing and grinding tools to eliminate heat. Self-contained, the equipment can be installed in a few minutes and is ready for service when connected with a shop line supplying air at 25 to 150 psi. Size and volume of the spray is controlled by a needle valve, which also acts as a shutoff. Air con-

sumption is at the rate of 0.04 cfm, and a gallon of coolant is said to last fourteen hours under average conditions. One- and 5-gallon containers are available with single or multiple outlets.

Circle 14E on reply card

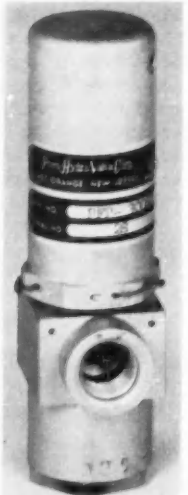
For the protection of concrete forms of plywood, L. Sonneborn Sons, Inc., is offering a finish consisting of a blend of synthetic resins in a quickly evaporating solvent. Free from grease, wax, oil or varnish, it is said to permit smooth, clean stripping of the forms without pitting the concrete and their reuse from eight to twelve times before recoating.

Circle 15E on reply card

Pneu-Hydro Valve Corporation has reported the development of a lightweight air-pressure reducer for aircraft and industrial pneumatic systems. According to the manufacturer, sturdy, simple construction gives the unit a long, dependable and trouble-free life. Depending on the size, it weighs from 0.4 to 0.6 pound, has a normal temperature range from -65 to 225°F and is available in standard tube sizes of 1/4 and 3/8 inch. Larger ones are made to specifications. The regulator has a rated capacity of up to 3000 psi and is obtainable with or without a built-in relief valve.

Circle 16E on reply card

Costly internal corrosion of stored pipe and tubing may be guarded against by the use of rugged neoprene end caps developed by Protokap, Incorporated. Two types are available: a lightweight roll-on cap for pipes 2 to 10 inches in



diameter and a heavier slip-on variety for up to 20-inch piping. The caps are resistant to oil, chemicals, sun and weather and can be used repeatedly because they withstand rough handling. They serve as an effective seal against air, moisture, corrosive fumes and dust.

Circle 17E on reply card

Electro Refractories & Abrasives Corp., has announced the development of "air-conditioned" grinding wheels made of aluminum oxide or silicon carbide. Called 20 Structure, these vitrified wheels are said to permit fast and cool cutting, to resist loading, to take

## ONE OR A DOZEN THE BEST VALUE **MAXIM** IN NOISE CONTROL **SILENCERS**

The best value because Maxim, the pioneer company in silencing, can point to a store of practical experience second to none in the field of noise control... because Maxim can bring to your problems more years of research, engineering and design experience. Whether your silencing application is standard or "special", Maxim can do more for you.

### SILENCERS FOR:

- INTERNAL COMBUSTION AND STEAM ENGINE EXHAUST AND INTAKE
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- BLOWER INTAKES AND DISCHARGES
- STEAM, AIR OR GAS DISCHARGES
- JET ENGINE EXHAUST AND INTAKE
- WASTE HEAT RECOVERY

### THE MAXIM SILENCER COMPANY

Subsidiary of Emhart Manufacturing Company  
61 Homestead Ave., Hartford, Conn.

Gentlemen: Please send bulletins on silencers for:

NAME

COMPANY

ADDRESS

Circle 18A on reply card

heavier bites and to eliminate burning and distortion caused by heat generation. They are designed for both horizontal and vertical spindle surface grinding, for tool and cutter grinding as well as for cylindrical and internal grinding of hard and soft steels, carbides, brass, aluminum, copper, rubber rolls and wood.

*Circle 18E on reply card*

Mechanical and pneumatic signals can be converted to d-c current for long-range transmission and then reconverted to pneumatic pressure for the purpose of actuating control valves or other pneumatic equipment, according to Fielden Instrument Division of Robertshaw-Fulton Controls Company. The P-E-P transmission system, as it is called, has a unique transmitter that uses a flexure mounted beam and air nozzle as an error detector and power amplifier to change pneumatic signals of 3-15 psi or equivalent mechanical outputs into 3-15 milliamperes d-c current, which is then converted by a receiver to 3-15 psi pressure.

*Circle 19E on reply card*

A pneumatic pressure regulator and shutoff valve has been developed by The Garrett Corporation's AiResearch Industrial Division for use in connection with pneumatic facilities in rocket, ram jet and turbine-engine test installations where the source gas is stored under high pressure. Operating with a closing time of 1/10 second, the regulator is designed to reduce gas at 3000 psi inlet pressure to a predetermined lower outlet pressure, acting simultaneously as a zero leakage shutoff valve. In addition to its normal functions, the unit can be utilized with any high-pressure industrial gas system.

*Circle 20E on reply card*

To regulate the air supply and pressure of auxiliary equipment such as unloaders, die lifters, coil feeders and other devices used in conjunction with power presses, Clearing Machine Corporation is offering an Automation Air Manifold as a substitute for the network of piping and fittings normally needed for the pur-



"Bill poo-hoos it but he hasn't caught anything yet!"

# FOUNDATION

## For Faster Installation and Lower Pipe Line Cost



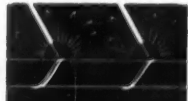
With Naylor lockseam-spiralweld pipe and the one-piece Naylor Wedge-Lock coupling, you have the basic ingredients for pipe lines that can be installed faster and at lower cost.

The light weight of this distinctive pipe makes it easy to handle and install on construction jobs. Its high ratio of strength to weight enables you to use it in service normally requiring heavy-wall-pipe — thus reducing material cost.

With the Naylor Wedge-Lock coupling, lines can be made up faster because pipe lengths can be joined more quickly than by ordinary methods.

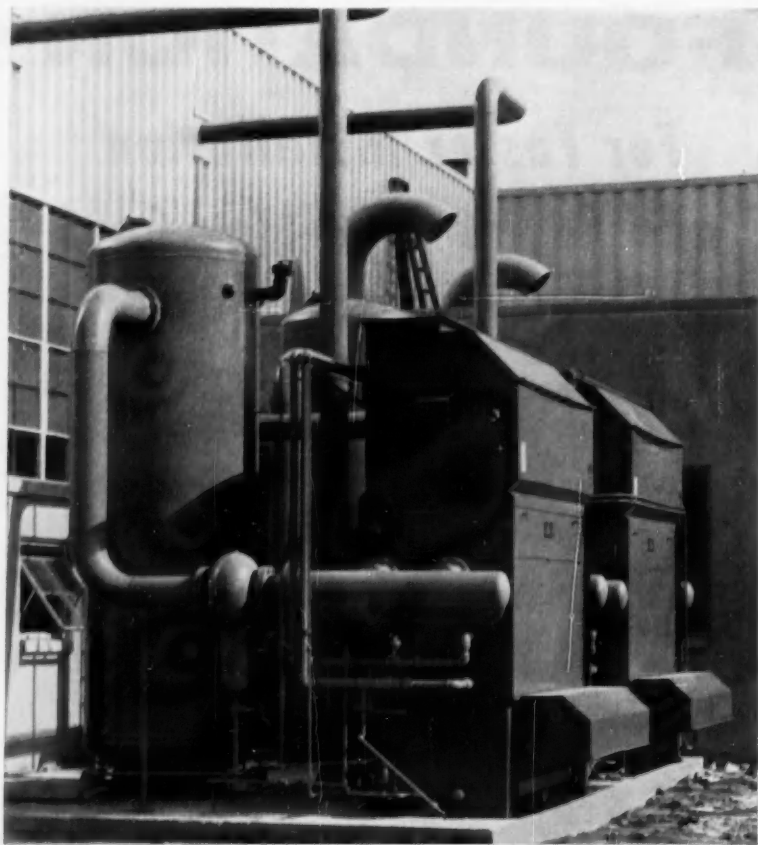
For the right start on water, air, ventilating and materials-handling lines, you'll be time and money ahead to specify these Naylor products.

Write for Bulletins No. 507 and No. 513.

**NAYLOR**  **PIPE**

Naylor Pipe Company • 1245 East 92nd Street, Chicago 19, Illinois  
Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

*Circle 19A on reply card*



*This Niagara Aero After Cooler also cools compressor jacket and intercooler water.*

## COMPRESSED AIR... Lower in Cost Dependably Drier and Cooler Trustworthy for Instrument Use

THE NIAGARA AERO AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient. Its drier air gives you a better operation and lower costs in the use of all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler in less than two years. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility air systems.

*Write for complete information; ask for Bulletin No. 130*

## NIAGARA BLOWER COMPANY

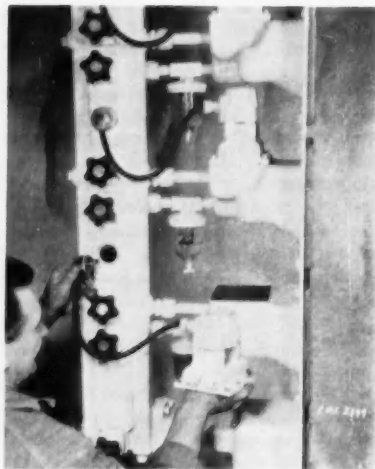
*Over 35 Years of Service in Industrial Air Engineering*

Dept. CA, 405 Lexington Ave.

New York 17, N. Y.

*District Engineers in Principal Cities*

pose. The main body of the 2- or 3-station header is an aluminum-alloy casting with cored ports for the air-inlet and exhaust connections and with oiltight compartments for electrical wiring. Weir-type valves, which require neither seats nor stem packing, are used for both shut-



off and exhaust functions. Under normal operation, exhaust from the solenoid valves is directed to a single port at the bottom of the manifold and piped either to an air silencer or basement. Solenoids, as the accompanying picture shows, can be easily unbolted and unplugged from their bases and lubricators removed from their adapter blocks.

*Circle 21E on reply card*

Twenty-four of the most popular polishing wheels, cones, blocks and mandrels made by Cratex Manufacturing Company for deburring, smoothing and polishing operations are offered in a polishing kit to familiarize metalworkers and repair and maintenance men with the advantages of its rubberized abrasives.

*Circle 22E on reply card*

Stainless-steel piston rings of new design and manufacture have been announced after three years of research by Sealed Power Corporation. Comparative tests show that they make it possible for modern automobiles to obtain in excess of 1000 miles per quart of oil, far more it is claimed than with rings of the familiar type.

*Circle 23E on reply card*

For the protection of the exterior surfaces of masonry The Tremco Manufacturing Company recommends its 102 Texture Coating, a rubber-base preservative that requires no primers or sealers. It produces a sand-like finish and is said to "breathe"—to allow vapors in the walls to escape while preventing the entrance of moisture. The compound is available in white and eight colors. Only one heavy film need be applied.

*Circle 24E on reply card*

## BRIEFS

A pair of bungalow-size bulldozers designed by R. G. LeTourneau, Inc., for the U. S. Air Force can remove a 200-ton crashed bomber from a runway in less than twenty minutes, work that formerly required from 5 to 15 hours when done by conventional methods. Officially called Crash Pusher and dubbed "Fantabulous," the huge vehicle has a powerful, high-torque electric motor directly geared to each wheel, thus making it an independent drive unit. If one or more of the wheels lose traction, the total horsepower is automatically transferred to the others.

Australia expects the recovery of minerals from its beach sands will eventually become one of its most profitable industries. Titanium and zircon, both much wanted right now, are plentiful there. Approximately 60,000 tons of various beach-derived minerals is now being exported annually and it is believed that in a few years their value will be second only to that of wool.

The Germans have developed an air-operated tool for digging sugar beets. Utilizing the same principle as a paving breaker, it drives a fork down beside the beet, thus loosening the earth so that the beet can be withdrawn undamaged. Experience thus far indicates that harvesting with the device is eight times as fast as by hand digging.

A British company is marketing an automobile vacuum cleaner that operates off a car's exhaust. A venturi-shaped extension is fitted over the exhaust pipe and has a hose take-off on one side. With the car engine running, enough suction is created through the hose to enable a nozzle at its inlet to pick up dust and dirt from the car interior.

Through a series of U. S. Weather Bureau radar units linked into a nationwide network of weather stations meteorologists will soon be able to detect and track hurricanes and tornadoes up to 250 miles away, thus making possible earlier storm warnings.

More students enroll each year in correspondence schools than in all the nation's colleges and universities. There are more than 400 such schools, of which 25 have been accredited. A list of the latter has been placed in all public libraries for references.

"The introduction of baths to colliery workers throughout Britain has uplifted the status of miners more than anything else in the history of mining" says J. H. Southall, secretary of the Midland Area of the National Union of Mineworkers,

**MORE POWER TO YOU**

**FOR THE**

**HIGH LIFT**

**M-H-F Model 202 Fork Lift**  
Power: Continental Red Seal Z-134 Engine



Like other leading makes of industrial tractors, Massey-Harris-Ferguson's newly-introduced WORK BULL line of light- and medium-duty utility units—gasoline and Diesel—features the plus value of power by Continental Motors, engine specialists since 1902.

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## WHY ROCKWELL- Nordstrom VALVES CUT COSTS

Rockwell-Nordstrom lubricated plug valves *stay* leakproof because they do not depend on uncertain metal-to-metal seating. Ordinary valve seats, even on routine services, soon score or pit, resulting in production hazards and costly maintenance.

Rockwell-Nordstrom valves employ *pressurized lubricant* between the plug and body for a tough, continuous seal that assures leakproof service on lightest gases or heavy slurries. The seat is *never* exposed to the line fluid and lubrication protects against corrosive-erosive material . . . maintenance costs are lower than any other valve. Rockwell-Nordstrom valves are always dependable because pressurized lubricant jacks the plug for perfect seating and instant, quarter-turn operation.

You can get Rockwell-Nordstrom valves in semi-steel, steel, stainless and other corrosion resisting metals in a full range of sizes. They cost no more, often less, than ordinary valves. Write for more details: Rockwell Manufacturing Co., Pittsburgh 8, Pa. *Canadian Valve Licensee: Peacock Brothers Ltd.*



### Rockwell-Nordstrom Valves

LUBRICANT SEALED FOR POSITIVE SHUT-OFF  
40<sup>th</sup> YEAR of lubricated plug valve leadership

*Circle 22A on reply card*

#### Industrial Books, Films and Literature

The forty-first annual edition of the *Chemical Engineering Catalog* is now available from Reinhold Publishing Corporation. A standard reference issued for the process industries, it illustrates and describes the equipment of more than 550 manufacturers supplying the field. It contains 1932 pages and for quick reference has six indexes—Company Name, Equipment and Materials, Plants and Specialized Services, Pilot Plants, Trade Names and a functional Guide—that will enable engineers and production men quickly to find any desired item. The publication is available free of charge to qualified personnel in the chemical engineering and process fields in the United States and Canada and may be obtained by writing on company letterhead to the publisher at 430 Park Avenue, New York 22, N.Y. Engineers in other countries are charged \$25 per copy.

Wire-rope manufacture from basic steel to final testing is the subject of *Quality Unlimited*, a 30-minute sound and color film distributed by Wickwire Spencer Steel Division of The Colorado Fuel and Iron Corporation. Applications and proper care of the cable receive special emphasis as does chemical and physical testing that accompanies each step in the manufacturing process. Inquiries concerning copies should be addressed to the company at 575 Madison Avenue, New York 22, N. Y.

For readers interested in automation, Catalogue No. 500 published by Prab Conveyors, Inc., may prove helpful. The bulletin not only covers the structural features and uses of its custom-built screw, belt, vibrating, pneumatic and other conveyor equipment, but includes data on its Magnavator, an automatic elevator for magnetically handling small parts; the Tube-veyor, an enclosed conveyor with a 2-directional chain for bulk material; and precision piano-hinge steel belt conveyors, parts feeders, etc.

*Circle 25E on reply card*

Series "A" nonrotating air cylinders are covered in Catalogue No. 110 issued by The S-P Manufacturing Corporation. Twenty-one models ranging from 1½ to 14 inches in bore size and designed to meet JIC standards are shown in the 12-page booklet. The units feature floating cushions, brass tubes to eliminate corrosion, removable bronze cartridges containing wiper and rod packing, and cold-rolled steel end plates.

*Circle 26E on reply card*

The second issue of *Lubrication Newsletter*, obtainable from The Alpha Molykote Corporation, features a technical article on the causes of galling and seizing in threaded connections and power screws and on how to prevent them through proper lubrication. Included are descriptive charts showing the coefficients of friction calculated from both torque-wrench measurements and test data using a threaded assembly.

*Circle 27E on reply card*

More than 400 electrical and mechanical products are listed in Catalogue No. 12 announced by Holub Industries, Inc. In addition to its regular items, the booklet contains information on new ones such as Lok-On wire connectors, Snap-On metal straps, a plastic-screw anchor kit, Tape-Mate fish tape winders and Ream-Rite for smoothing and beveling freshly cut ends of thin-wall conduits.

*Circle 28E on reply card*

*Accident Facts* (1956 edition), a 96-page statistical yearbook not only contains figures on all types of accidents but reports trends during the past 30 years as well. Twenty pages devoted exclusively to occupational hazards provide invaluable background ideas and data for directing industrial safety programs. Inquiries should be directed to National Safety Council, 425 North Michigan Avenue, Chicago 11, Ill. Price, \$1.00.

Weldless repairs of iron and steel tanks, conduits, containers and surfaces by means of epoxy resin and glass cloth are discussed in a technical bulletin published by the Smooth-On Manufacturing Company. A lamination procedure, it is described from start to finish and claimed to insure good adhesion to the metal and a strong, chemically stable, machinable job that can be painted or lacquered.

Circle 29E on reply card

The U. S. Stoneware Company has published a technical booklet that deals with its standard Tygon vinyl-plastic tubing for the safe transmission of fluids. Applications and limitations of each formulation are fully presented, along with charts and tables giving physical properties and chemical resistance based on A.S.T.M. testing methods.

Circle 30E on reply card

Morse Chain Company has prepared a chart that is said to reduce the time of selecting any of its roller-chain, Morflex or silent-chain couplings to a matter of minutes. Measuring 22x17 inches, it can be hung on the wall, inserted under a glass desk top or for filing and can be obtained from any Morse distributor or by writing to the company's Industrial Sales Division, Ithaca, N.Y.

R. & J. Dick Company, Inc., has published a 12-page price catalogue (No. CP-80) covering its complete line of Barry Conveyor Pulleys. The new catalogue not only gives costs and detailed specifications of conveyor pulleys but also includes drawings, illustrations and descriptive matter on all products.

Circle 31E on reply card

How the E. F. Hauserman Company's Divider-Wall can turn cluttered open floor space into effective, semiprivate work units is the subject of a new full-color brochure obtainable upon request. Color swatches, specification drawings and installation details of the movable interior walls are shown and discussed.

Circle 32E on reply card

Hills-McCanna Company has released a 2-color, 12-page catalogue (No. 100) describing the advantages, applications and specifications of its line of diaphragm valves. Three basic methods of operation—hand-wheel, lever and sliding-stem—are shown and dimensions are given.

Circle 33E on reply card

Coppus Engineering Corporation has made available Bulletin No. 500 dealing with eight types of Coppus Sentry full-flow valves. Design, function and specifications of each model are treated in considerable detail and cross-sectional diagrams of all valves are included.

Circle 34E on reply card

Vibration control and absorption of impact and noise in machinery installations are discussed in Bulletin No. 415B issued by MB Manufacturing Company, a Division of Textron Inc. Photographs and cross-section drawings of three basic mounting methods using Isomode Neoprene pads are included.

Circle 35E on reply card



**Yes! and here's how...**

Is compressed air-line condensate causing you to lose valuable production time? Do numerous blow-downs add to the cost of operating your compressed air system? Do you have a heavy air-tool maintenance load? These headaches are common when a compressed air system needs an Adams Aftercooler and Cyclone Separator . . . where your compressor discharges directly into the receiver. With Adams units, your compressor discharges hot, vapor-laden air into the Aftercooler. Here the air temperature is reduced to within 10° F of the cooling water. As a result, excess water and oil vapors are condensed.

The Cyclone Separator removes virtually all condensate from the air as it flows from the Aftercooler. That's because the Adams design achieves a high separating factor—even over wide ranges of flow.

Compressed Air, conditioned by this Adams team—Pipe Line Aftercooler and Cyclone Separator—normally enters the distribution system below the ambient temperature. Thus, there can be no further condensation to cause you trouble.

For Twenty Years the Adams team has given thousands of customers dependable, trouble-free compressed air. So, if your plant has problems due to condensate in your air lines, there's a simple answer. Write for our Bulletin 711 and see for yourself.

## R. P. ADAMS CO., INC.

209 East Park Drive • Buffalo 17, New York

R. P. ADAMS COMPANY, INC.

209 East Park Drive, Buffalo 17, N. Y.

We have a compressed air condensate problem. Please have your local representative call on us.

Name.....Title.....

Firm.....

Street.....

City.....State.....

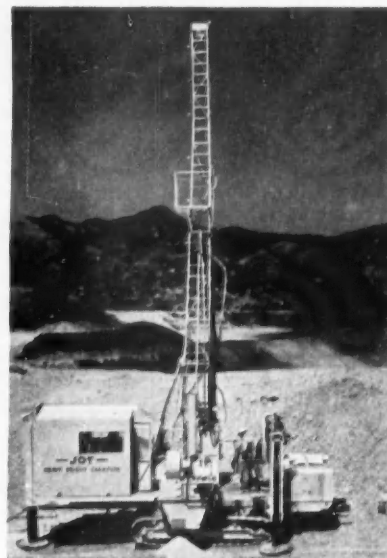
Circle 23A on reply card



▲ **TWO-AND-A-HALF-INCH SEALTITE** containing motor lead cable is attached to rigid conduit on Super Heavy Weight Champion Drill. Flexibility of Sealtite means fast, simple installation.

◀ **ONE-INCH SEALTITE** is installed to junction box. This particular box is necessary because tower must be removed for shipping. Sealtite withstands weathering, dust and vibration.

**HEAVY WEIGHT CHAMPION Drill** takes 40 feet of Sealtite in three sizes. Big brother, Super Heavy Weight, uses about 200 feet of flexible, liquid-tight conduit.



## Flexible, liquid-tight conduit speeds up wiring on blast hole drills

### "Sealtite" cuts installation time 20%—drill manufacturer reports

This large drill is not pampered. It is used in the field under every conceivable climatic and atmospheric condition. Thus, every component, including the electrical conduit, must be rugged to stand the weather, the abrasive dust and severe vibration.

Formerly, the manufacturer used a rigid type of conduit. But it was difficult to install around bends and in tight spaces. In 1953, they switched to Sealtite flexible, liquid-tight conduit. This flexible conduit has meant a 20% saving in labor time, improved the appearance of the wiring job—

and all the time has delivered 100% in the field.

Manufacturers find Sealtite easier to stock...takes up less storage space.

#### WHERE TO GET SEALTITE

Electrical wholesalers stock Types U. A. and E. F.† Sealtite\* flexible, liquid-tight conduit in easy-to-handle coils. Be certain you ask for, and get, the quality conduit marked "Sealtite" on the cover. Buy it in long lengths and cut it on the job without waste. Special liquid-tight connectors by

Appleton, Thomas & Betts, Gedney or Pyle-National are available. Free Booklet S-537 gives full information on Sealtite. Write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn.

\*Trade Mark

†Pat. Applied for

00192

Insist on the original

**SEALTITE**

flexible, liquid-tight conduit

an **ANACONDA**® product





**The Wagonjack** cuts drilling time in half for scores of jobs. How? Powered forward drill feed, positive feeding pressures, maneuverability, and

use of long drill steel. It's a good way to save money. And also to eliminate much of the heavy, tiring work previously performed by manpower.

## More than 50 parts strengthened by Nickel Alloy Steels

### In Ingersoll-Rand Wagonjack Drill Rigs

THIS EQUIPMENT drills up to 31" per minute through solid granite, depending on air pressure and bit size. It drills at extreme speeds with surprisingly little gage wear. And with a minimum of bit changes.

Look into this WAGONJACK! A real *one-man mounting*, it speeds up work on any job.

You'll find that nickel alloy steels add stamina to more than 50 vital parts of this rig. Ratchet, rifle bar, driver and chuck are made especially durable by using nickel steels.

And think of the terrific beatings taken by rock drill frontheads and chuck bearings. These parts stand the gaff, because Ingersoll-Rand makes them from tough nickel steels that resist breakage.

Heart of the rock drill . . . valve chest and

guide . . . is of nickel steel, too. Because in reversing some 4000 times per minute, the valve calls for seating faces that *stay true*. Otherwise efficiency falls.

Under the most severe working conditions, you'll find that the desirable combination of strength, toughness and hardness of steels containing nickel can assure dependability of all such vital parts.

When you have a metal problem, make use of our wide practical experience. Let us show you how a nickel alloy may be the exact answer you are looking for. Send details of your difficulty for our suggestions. Take the first step now . . .

**Write for List A** of available publications. It includes a simple form that makes it easy for you to outline your problem.



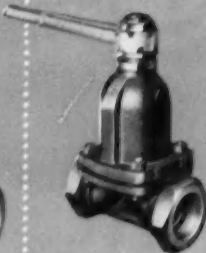
**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N. Y.

# ALL-PURPOSE VALVE

for handling materials as diversified as corrosive fluids, gases, beverages, viscous materials, foods, compressed air, solids in suspension.



Handwheel Operated



Lever Operated



Power Operated

## Grinnell-Saunders Diaphragm Valve

Unsurpassed on lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

In industries as varied as mining, food, textile, pulp and paper, beverage, water and sewage, chemicals . . . Grinnell-Saunders Diaphragm Valves continue to win enthusiastic acceptance. The unique design of the valve — with its flexible, long-wearing, tight-closing diaphragm — offers many unusual advantages.

If you have a valve problem, it will pay you to write Grinnell for further information.

# GRINNELL

WHENEVER PIPING IS INVOLVED

### Choice of Materials

**Bodies** — iron; cast steel; stainless steel; Durimet 20; Hastelloy A, B, C; bronze; Monel; aluminum; PVC (polyvinyl chloride); Saran

**Body linings** — hard rubber; soft rubber; neoprene; glass; lead; plastics; Heresite; Lithcote

**Diaphragms** — soft natural rubber; natural rubber; white synthetic rubber; neoprene; reinforced neoprene; butyl; Hycar; Teflon; Kel-F; PVC (polyvinyl chloride); polyethylene

**Bonnets** — iron; stainless steel; bronze; other materials on special order

### Choice of Bodies

Conventional weir type

**Straight bodies** — screwed; flanged; socket weld; butt weld; socket (solder); sanitary threads; hose ends; Victaulic

**Angle bodies** — screwed; flanged; socket weld

Other types

A line of Straightway Valves (for straight-thru flow) and Full-Bore Valves (for ball brush cleaning) also are available

### Choice of Bonnets

Handwheel (non-indicating stem, indicating stem); chain wheel; lever (for quick operation); sliding stem (for a wide selection of power operated topworks)

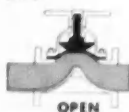
### Operating Features

- diaphragm absolutely isolates bonnet mechanism from the fluid in the line

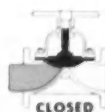
- diaphragm lifts high for streamline flow in either direction

- diaphragm presses tight for positive closure

- simple maintenance — diaphragm easily replaced without removing valve body from line



OPEN



CLOSED



Grinnell Company, Inc., Providence, Rhode Island

Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves  
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies  
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



## There are 69 reasons why

—Diehl can build better motors. For 69 years, successive generations of Diehl motor specialists have applied their accumulated know-how to solving the power problems of widely divergent types of industries. In the smallest shops or the largest plants—all over America—Diehl men study the problem along with the customer. Name your motor requirements—no matter how “different,” it’s more than likely that an almost-similar situation has been recently brought to a successful conclusion with Diehl action. Here’s where Diehl know-how helps you. The right answer and the right motor—at the most reasonable cost—can be yours, fast! Designed and built for your job. Get all the power and get it right—from Diehl.



### DIEHL MANUFACTURING COMPANY

Electrical Division of THE SINGER MANUFACTURING COMPANY  
Finders Plant, Somerville, N. J.

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*You invest in Performance*

**when you design with DIEHL.**

INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE  
AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES

*H*

ere's a 20 horsepower air-cooled  
compressor ready to go to work.

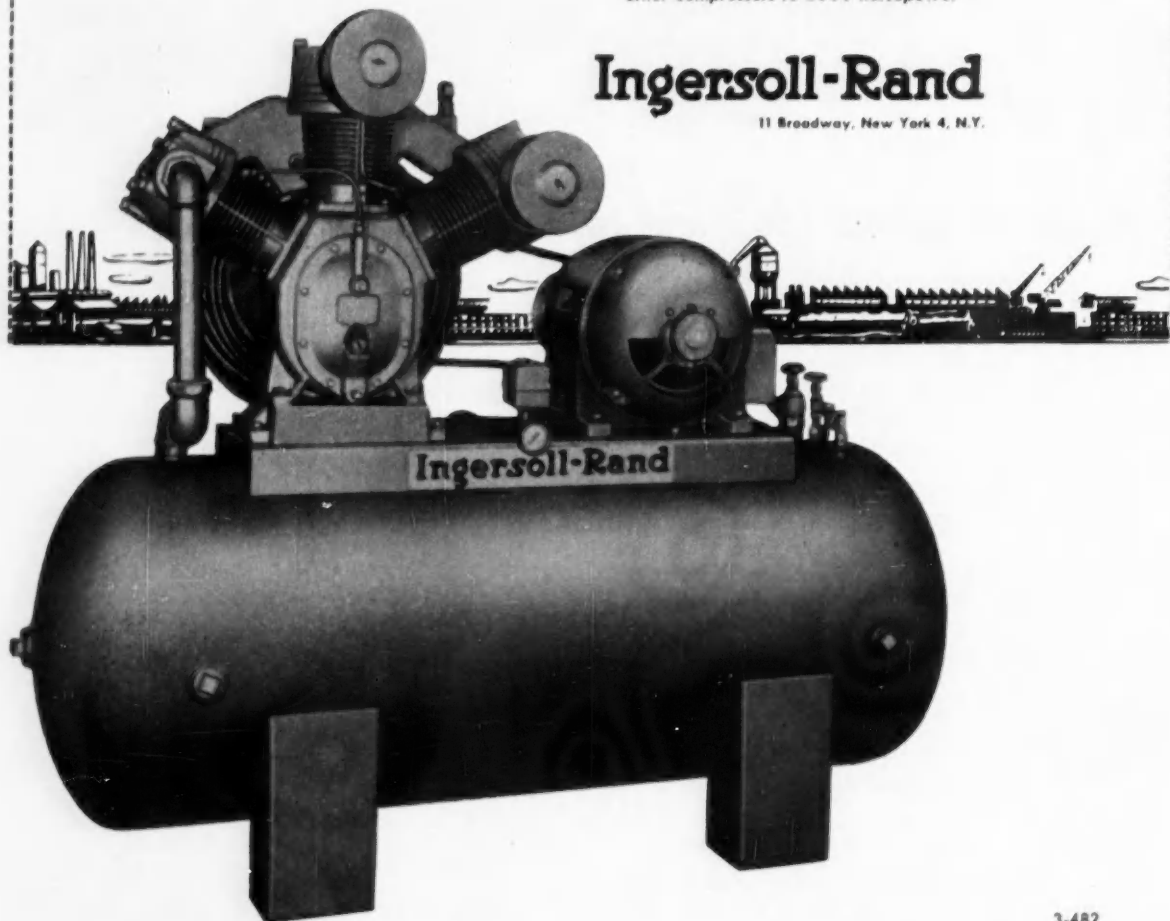
To someone, its dependability and  
efficiency can mean the difference  
between production profit and loss.

If you need a new air compressor,  
don't gamble . . . make sure  
you get the best.

*Packaged air-cooled compressors—  
1/2 through 20 horsepower  
other compressors to 6000 horsepower*

**Ingersoll-Rand**

11 Broadway, New York 4, N.Y.



3-482

# Eleven lines of WALWORTH Saddle Type Wedge Gate Valves

**Bronze-Mounted — All-Iron — Ni-Resist**

**Outside Screw and Yoke — Non-Rising Stem — Quick Opening  
Flanged Ends — Screwed Ends**



Walworth saddle-type wedge gate valves are manufactured in eleven different combinations of designs and materials, seven of which are illustrated above.

Saddle type wedge gate valves are easy to take apart and are particularly suitable for lines requiring frequent cleaning. Walworth Saddle-Type Wedge Gate Valves are available in a variety of designs including OS & Y; Inside Screw Rising Stem, and Sliding Stem Quick Opening types—in Bronze-Mounted, All-Iron, and Ni-Resist. All types are designed to permit repacking under pressure in either the open or closed position.









**FOR COMPLETE INFORMATION, See your local Walworth  
Distributor or write on business stationery for illustrated circular.**

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

# WALWORTH

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SUBSIDIARIES:  **ALOYCO** ALLOY STEEL PRODUCTS CO.  **CONOFLOW** CORPORATION  **GROVE VALVE & REGULATOR CO.**  
 **SOUTHWEST FABRICATING & WELDING CO., INC.**  **M & H VALVE & FITTINGS CO.**  **WALWORTH COMPANY OF CANADA, LTD.**

**Portable,  
Accurate,  
Reliable**

These are the qualities Northrop Aircraft, Inc. finds in the TOOL-OM-ETER which enables them to control costs by improving maintenance of their air tools.

You will find these same "built-in" qualities in every TOOL-OM-ETER to help you better evaluate the condition of your air tools and other pneumatic equipment.

Why not tell us your problems in the use of compressed air . . . or write for Bulletin A-8 which tells you how our meters work and the sizes and capacity ranges available.



NORCRAFTER Virgil T. Phillips using a 1" TOOL-OM-ETER, TO-40, to test a portable pneumatic tool at Northrop Aircraft in Hawthorne, Cal. Norcrafter Phillips finds the TOOL-OM-ETER a real timesaver in his work as Small Tool Repairman.

**NEW JERSEY METER CO.**

*"Specialists in Compressed Air Devices"*  
**PLAINFIELD, NEW JERSEY**

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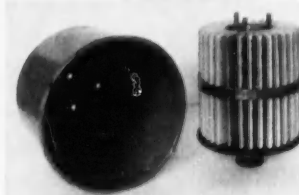
Compressed Air Data (Fifth Edition) \$3.00

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- Street No. ....
- City .....State .....Country .....

**NEW DRY TYPE AIR FILTERS**  
**for engines, compressors, blowers**  
**and other industrial applications**



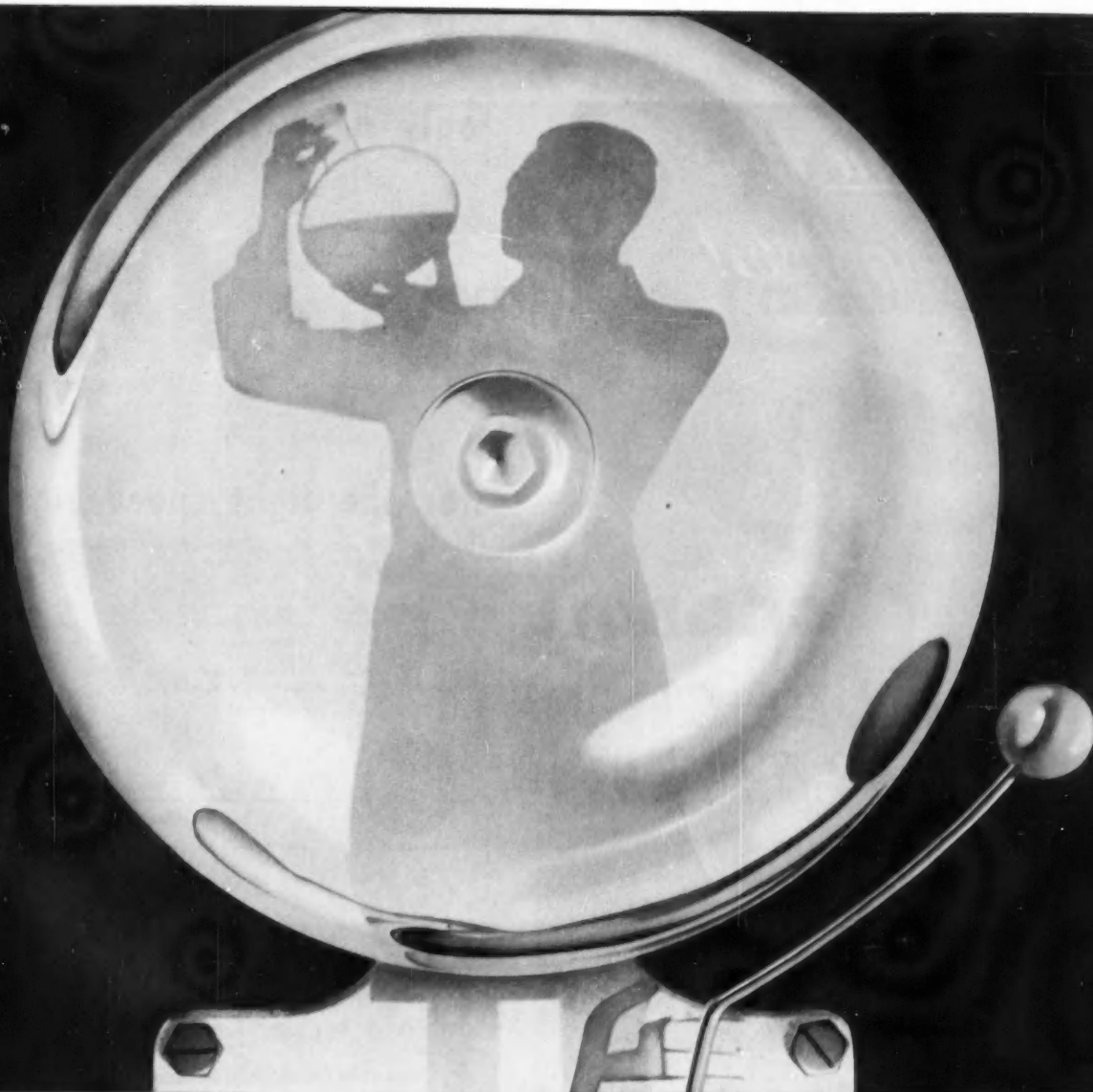
- Designed for specific applications, the new Air-Maze Dry Type filter is particularly suitable where 1.) oil free air is required, 2.) an extremely high degree of filtration is required, 3.) the air velocity varies from one

period to another and, 4.) the dirt concentration is relatively low, except when vibration is present to help dirt removal.

The Air-Maze Dry Filter is one of the most efficient mechanical type filters available. Laboratory tests indicate better than 98% efficiency with particles of 2 micron mean diameter and practically 100% efficiency with particles of 5 microns or larger.

The Air-Maze Dry Filter type DA employs a special highgrade felt filtering media arranged in deep pleats to provide extended area, and armored on both sides by heavy galvanized cloth. Heavy gauge perforated tubing inside the media and a metal strap on the outside form a rigid unit of great strength and are corrosion protected. Made in sizes from 20 cfm to 6650 cfm. Catalog DA-1056 available. Write AIR-MAZE CORPORATION, Cleveland 28, Ohio.

Circle 30A on reply card



## matching wits with fire

**Fire-resistant Celanese Cellulubes provide protection against the costly damage of fires and explosions.**

When employed as the hydraulic fluid in die casting and similar critical operations, Cellulubes reduce the ever-present danger of uncontrollable fires caused by line breaks or other equipment failures. As air cylinder lubricants in compressed air systems, Cellulubes prevent the formation of excessive carbon deposits—the main source of compressor fires and explosions.

Possessing stable physical properties, Celanese Cellulubes provide high performance and safety during continuous duty under critical conditions. This stability contributes to the fluid's

longer life, an economy factor further enhanced by the fluid's reusable property, permitting reuse of spillage. Straight phosphate esters, Cellulubes contain no additives. They're non-reacting, non-carbon-forming, non-corrosive, fire-resistant chemical compounds with excellent lubricity.

Available in 6 controlled viscosities, Cellulubes can be supplied by Celanese to meet exacting requirements in the replacement of flammable fluids presently in use. Play it safe, write for complete data and technical assistance.

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CHEMICALS

### .....for improved products

Agricultural, automotive, aviation, building, electrical, paper, pharmaceutical, plastics, surface coatings, textile.

*Use One Hose for  
Many Jobs!*



## GOODALL "ALLSERV" General Purpose HOSE

"ALLSERV" will not only give long, reliable service on air and pneumatic tools, but will prove equally efficient in the handling of water, oil, gasoline, paint and insecticide spraying, grease guns, etc. The adaptability of this one hose to such a wide variety of applications provides a sure way to keep hose inventory low.

"ALLSERV" is a very flexible all-"Synplastic" (R) molded-and-braided hose, in one, two or three braid construction, with a tough wear-resistant red cover. Made in sizes  $\frac{1}{4}$ " to  $1\frac{1}{2}$ ", for working pressures from 200 lbs. to 300 lbs. Available in maximum lengths of 500 feet.

Contact Our Nearest Branch  
for Further Details and Prices

*"If it's GOODALL, it MUST be Good!"*

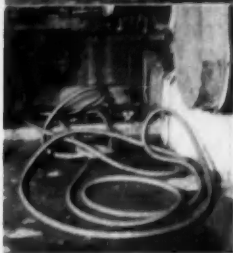
Standard of Quality—Since 1870



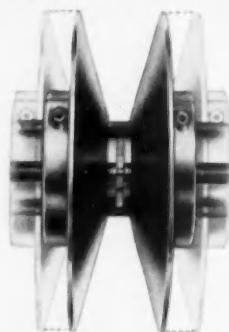
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AND OTHER INDUSTRIAL RUBBER PRODUCTS

### GOODALL Rubber Company

GENERAL OFFICES, MILLS AND EXPORT DIVISION, TRENTON, N. J.  
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only a twist of the wrist



for the right speed setting

Wood's offers the simplest variable speed sheave on the market today! So easy to change speeds. Simply turn the single adjusting screw from either side to change pitch diameter. With the speed chart furnished you can adjust the sheave to the desired speed without trial and error. Simplified design provides positive clamping of the two adjustable flanges . . . eliminates fretting corrosion. Single wide range belt gives maximum HP efficiency. Does away with the problem of maintaining matched belts and matched grooves.

Write for Bulletin #497.



T. B. WOOD'S SONS COMPANY

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Circle 33A on reply card

## Air Traps STRANGLER by OIL?



Get **ARMSTRONG** Inverted Bucket Air Traps —  
They Remove Water and Oil — **without clogging**

When heavy-duty compressors pump oil, ordinary ball float traps will clog up. With Armstrong inverted bucket traps, oil floats to the top — is discharged ahead of the water.

No trouble with dirt, either. It stays in suspension and is washed out with the water . . . no dead spots for it to collect . . . can't settle on valve or seat—they're at top of trap.

Fits anywhere—installs above drip point, as well as below.

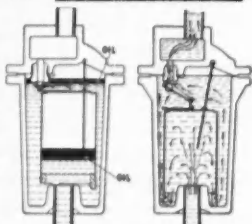
Other advantages:

- Scrubbing wire keeps bucket air vent from clogging.
- Open bucket float can't collapse.
- All stainless steel mechanism lasts for years.



Send for Free Bulletin No. 2033  
Gives full information, including prices, for selection and installation help.  
Call your local Armstrong representative, or write:

**ARMSTRONG MACHINE WORKS**  
885 Maple Street, Three Rivers, Michigan



CLOSED

OPEN

**HOW THEY WORK**

**CLOSED:** Oil collects on top of water in trap. Air in trap floats bucket. Valve held closed by pressure.

**OPEN:** When water disperses air in bucket, bucket sinks, pulls on lever and opens valve. Oil floats out along with condensate.



**Satisfaction Guaranteed**

Circle 34A on reply card

# Not Just CORROSION-RESISTANT **BUT** CORROSION-PROOF



Corrosion resistance is not enough to stop acids or alkalis from chewing up a motor in a hurry. That is why the wise engineer selects Reliance Corrosion-Proof Motors for corrosive service.

These motors are built to withstand the onslaught of destructive chemicals for years. Housings are made of virtually indestructible cast iron. Exterior contours are designed to slough off liquids—no nooks and crannies to retain corrosive elements. Enclosures are sealed to prevent any leakage . . . Metermatic lubrication systems provide complete protection against burned out bearings and contaminated lubricants.

Anyway you look at them, Reliance Corrosion-Proof Motors can take it—and you're not limited in the choice of motors either. A complete line of a-c. motors, 1 thru 300 hp., is available in all mountings, frequencies and voltages.

Why not call your Reliance representative today and get all the details.

B-1506

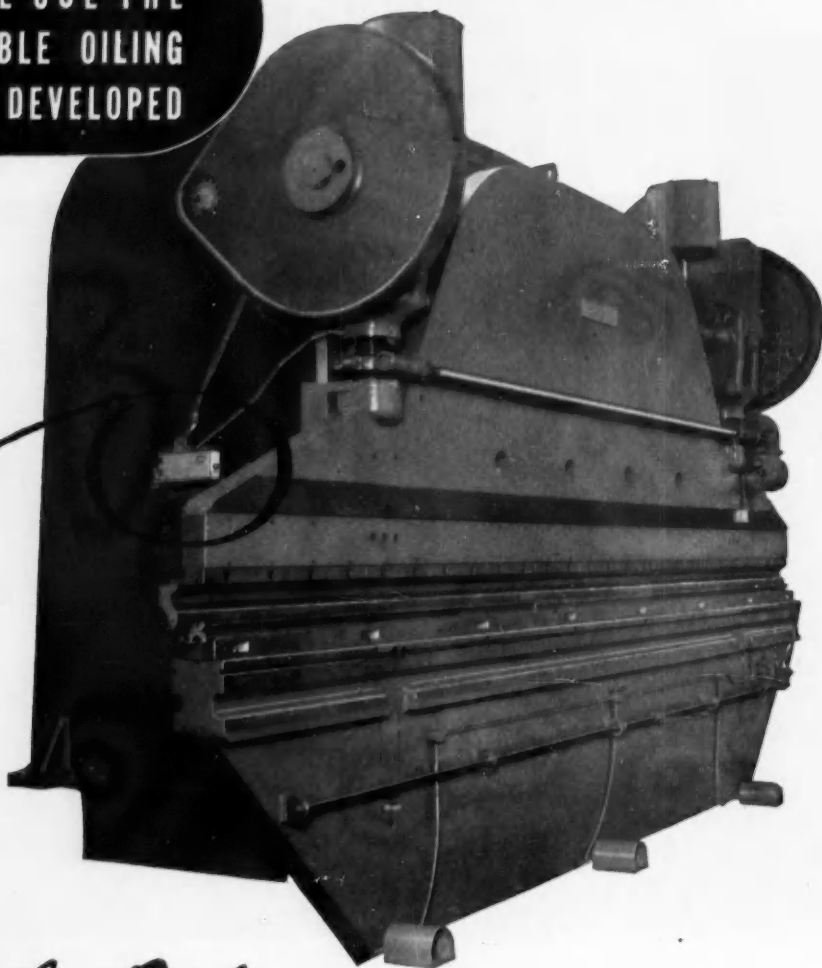
**RELIANCE**  
*Totally-Protected*  
**MOTORS**

**RELIANCE** **ELECTRIC AND  
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**MACHINES OF GREAT  
PERFORMANCE USE THE  
MOST DEPENDABLE OILING  
SYSTEM EVER DEVELOPED**

Illustrated is Madison-Kipp Lubricator Model FD installed as original equipment on a  $\frac{3}{4}$ " by 20" Cincinnati Press Brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio.



**MADISON-KIPP**

*Fresh Oil*

... by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

## **MADISON-KIPP CORPORATION**

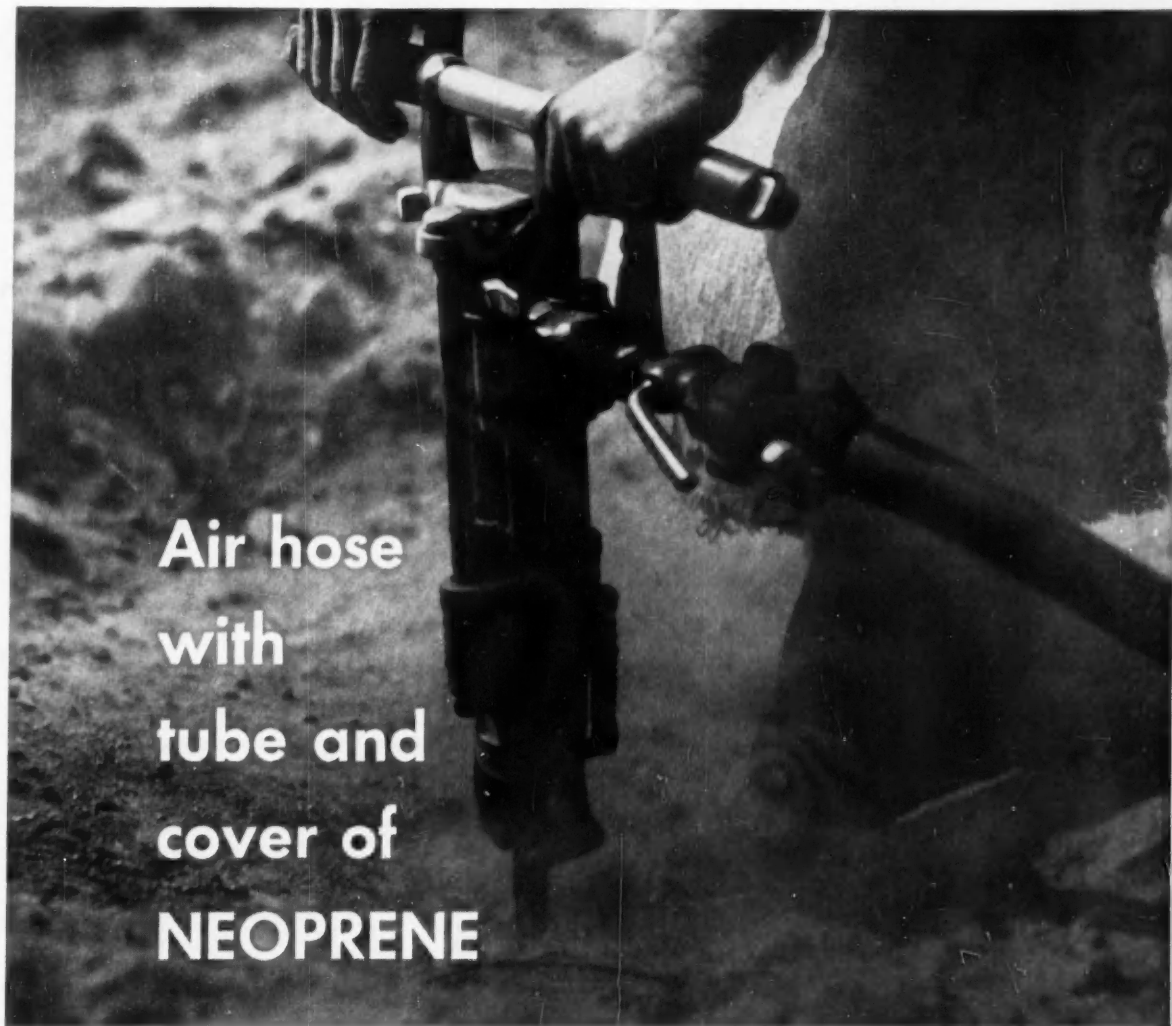
202 Waubesa Street, Madison 10, Wis., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

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# Air hose with tube and cover of NEOPRENE

## Here's a rugged hose that can cut your replacement costs

**EXTRA PROTECTION** inside and out—that's the secret of the long, cost-saving service life of air hose made with Du Pont neoprene.

**STURDY HOSE TUBES** of neoprene resist the lubricating oil present in the air supply. Neoprene won't get soft and sticky, or crumble off and plug tool parts.

**RUGGED HOSE COVERS OF NEOPRENE** resist abrasion and cracking. Yank this hose over jagged rocks—there's no chipping. Twist the hose around sharp corners—there's no cracking. And it continues to give this kind of service

even though it is exposed to oil and grease, sunlight and weather.

**THAT'S WHY HOSE** with neoprene cover and tube is original equipment on so many portable compressors. So buy or replace with the best . . . ask for durable neoprene next time you need air hose.

**FREE! THE NEOPRENE NOTEBOOK.** Each issue brings you new, unusual applications of neoprene . . . new products . . . interesting articles. Send in this coupon to E. I. du Pont de Nemours & Co. (Inc.), Elastomers Div. CA-6, Wilmington 98, Del.



# NEOPRENE

The rubber made by Du Pont since 1932



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# Why You Should Specify...



## MOTORS & GENERATORS



### Dependability

accepted by Leading National Manufacturers



### Wide Range of Sizes

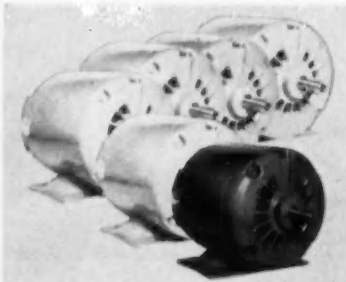
motors 1/20 H.P. to 2500 H.P. Generators 1/2 K.W. to 2000 K.W.

Built to Your Specifications



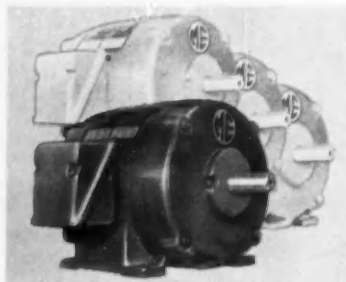
### Nationwide Service

A Service Station and District Office is near you



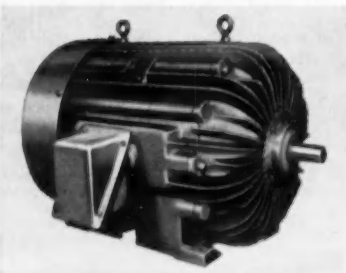
FRACTIONAL H.P. MOTORS

General Purpose:  
1/20 HP-up From Stock  
Special Purpose:  
Built to YOUR Specifications



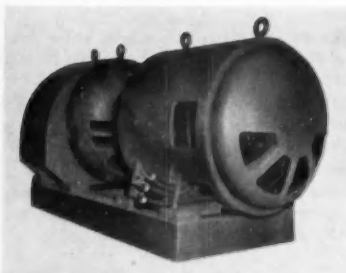
NEW NEMA INTEGRAL HP MOTORS

Provides 4 in 1 Protection:  
Drip-proof . . . Splash-proof  
Weather Protected . . . Guarded.  
All at Open Motor Prices



TOTALLY ENCLOSED FAN-COOLED MOTORS

Ribbed Frame Construction:  
Cool, Clean, Efficient  
Explosion Proof Ratings to 250 HP  
Carry This Label



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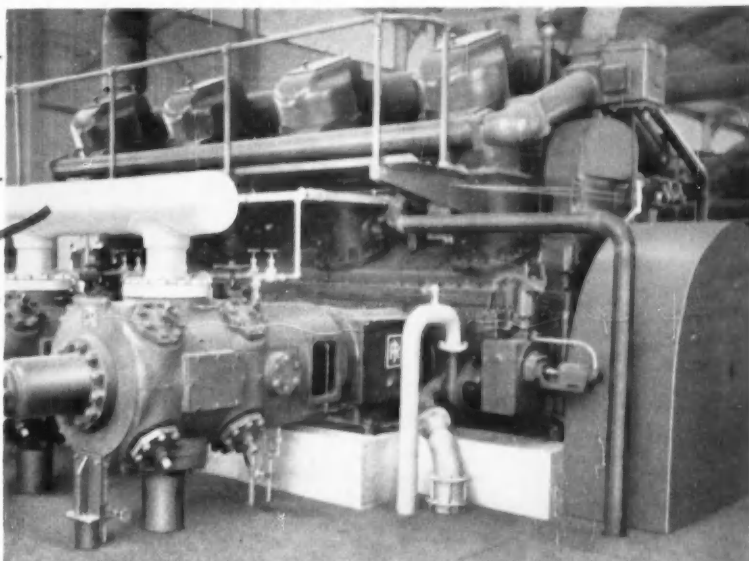


# ELECTRIC

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# A NEW HIGH FOR I-R GAS-ENGINE COMPRESSORS



One of seven KVG Gas-Engine Compressors at Big Piney Station of Pacific Northwest Pipeline.

## Seven KVG Units at 7,325 ft. altitude deliver gas from **BIG PINEY FIELD** to Pacific Northwest Pipeline

**T**he Big Piney Station of the new Pacific Northwest Pipeline system is of special interest for two reasons.

Located at an elevation of 7,325 ft above sea level, it is the highest pipeline compressor station in the country—operating in temperatures ranging down to 40° below zero.

It has made possible the commercial utilization of Big Piney Field, which has been shut in for the past 18 years by lack of transportation facilities.

Hence it was quite appropriate that opening ceremonies for the Pacific Northwest Pipeline were held at Big Piney—where seven Ingersoll-Rand KVG Gas-Engine Compressors boost field gas to pipeline pressures. Two 880-hp units and two 660-hp units operate with intake pressures of 100-350 psi and discharge pressures of 400 to 550 psi. Three more 660-hp units have intake from 400 to 550 psi and discharge pressures of 650 to 850 psi.

Because of the extremely high altitude, the gas engines were supplied in bigger-than-normal sizes. Combined rated horsepower of the seven Big Piney units would be 5,060 hp at normal 1,000 ft altitude—for an actual load of about 3,885 hp under average conditions. The station is completely "winterized" for dependable operation at sub-zero temperatures.

Ingersoll-Rand Gas-engine Compressors now serving the various stations of the Pacific Northwest Pipeline include the following types and sizes:

SVG compressors, 330 hp  
KVG compressors, 660 and 880 hp  
Turbocharged KV5 units, 1000 and 2000 hp  
PKVG Gas Engine Power Units, 1100 hp

For maximum stability, flexibility and long-range economy under all pipeline conditions, it pays to specify Ingersoll-Rand four-cycle gas-engine compressors. Your I-R representative will gladly give you complete information on the units best suited to your needs.

# Ingersoll-Rand

11 Broadway, New York 4, N. Y.



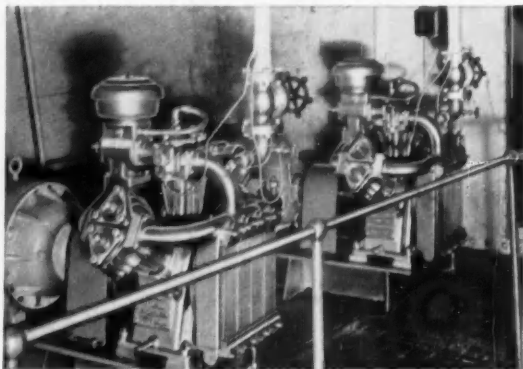
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COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • GAS & DIESEL ENGINES

Circle 39A on reply card

# From shops to ships, mints to mines

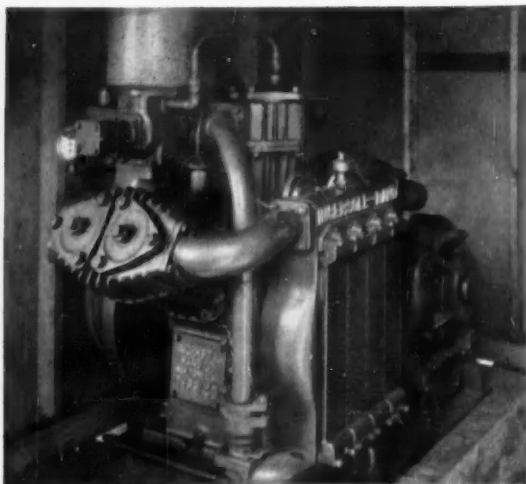
## ...TIMKEN® bearings help keep compressors trouble-free



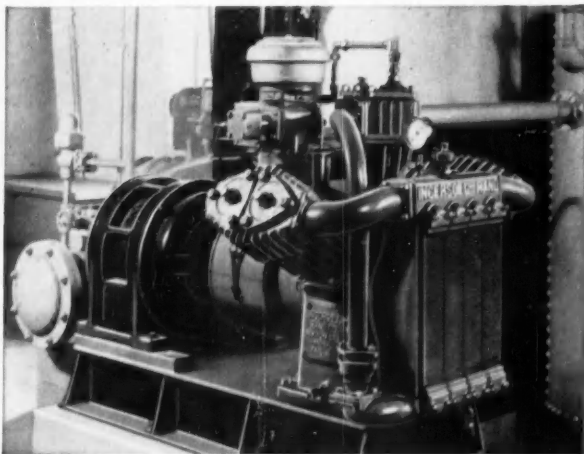
**1. SEAGOING COMPRESSORS STAY SHIP-SHAPE—WITH HELP OF TIMKEN® BEARINGS.** A tanker gets air for general ship service from these Ingersoll-Rand Type 40 compressors. One reason there's little chance of a breakdown: the crankshaft is mounted on Timken® tapered roller bearings. The shaft and adjacent parts are always held in proper alignment because the tapered design of Timken bearings enables them to take any combination of radial and thrust loads.



**2. KEEPS UP PLANT'S AIR SUPPLY WITH TIMKEN BEARINGS TO HOLD DOWN WEAR.** This Ingersoll-Rand Class ES compressor supplies a whole plant with air. Its crankshaft is mounted on Timken tapered roller bearings to insure a steady supply and hold down wear. Timken bearings hold wear to the minimum because they practically eliminate friction. Reason: they're designed to roll true and they're made with microscopic accuracy to conform to their design.






**3. COMPRESSOR HALTS MINE CARS—TIMKEN BEARINGS HALT WEAR.** This Ingersoll-Rand compressor works in an open pit mine. It provides air for air brakes used to spot railroad cars during the loading operation. Crankshaft wear is reduced by mounting it on Timken tapered roller bearings. They're made of steel so fine we have to make it ourselves. We're the only U. S. bearing manufacturer that takes this extra quality step.





**4. COMPRESSOR CUTS COST OF MAKING MONEY—WITH HELP OF TIMKEN BEARINGS.** Ingersoll-Rand's 25-hp Type 40 compressor supplies the general air in this government mint. To keep the compressor on the job, I-R mounts the crankshaft on Timken tapered roller bearings. Timken bearings handle the crankshaft loads with ease because full line contact between rollers and races gives them load-carrying capacity to spare. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

**TIMKEN**  
TRADE-MARK REG. U. S. PAT. OFF.  
**TAPERED ROLLER BEARINGS**



NOT JUST A BALL  NOT JUST A ROLLER  THE TIMKEN TAPERED ROLLER 

BEARING TAKES RADIAL  AND THRUST  LOADS OR ANY COMBINATION 